Republic of Iraq - Ministry of Higher Education and Scientific Research

university of Misan

Bachelor's degree in Electrical Engineering (First cycle)

Four years (Eight semesters) - 240 ECTS credits - 1 ECTS = 25 hr

Program Curriculum (2023 - 2024)

جمهورية العراق - وزارة التعليم العالي والبحث العلمي

جامعة ميسان /كلية الهندسة

بكالوريوس في الهندسة الكهربائية (الدورة الأولى)

أربع سنوات (ثمانية فصول دراسية) - ٢٤٠ وحدة اوربية - كل وحدة اوربية = ٢٥ ساعة

المنهاج الدراسي للعام ٢٠٢٣-٢٠٢٤

Level	Semester	No.	Module Code	Module Name in English	اسم المادة الدراسية	Language	SSWL (hr/w)						Exam hr/sem	SSWL hr/sem	USSWL hr/sem	SWL hr/sem	ECTS	Module Type	Prerequisite Module(s) Code
							CL (hr/w)	Lect (hr/w)	Lab (hr/w)	Pr (hr/w)	Tut (hr/w)	Semn (hr/w)							
UGI	One	1	EL111	fundamental of electrical engineering I	الاسس الكهربائية I	English	4		2		1		4	109	91	200	8.00	C	
		2	EE112	Mathematics I	الرياضياتI	English	4				1		3	78	72	150	6.00	B	
		3	EE113	Basic physics	الفيزياء الاساسية	English	3				1		3	63	62	125	5.00	B	
		4	UM114	Computer Programming	برمجة الحاسب الآلي I	English	2		2				4	64	61	125	5.00	S	
		5	EE115	Engineering Drawing	الرسم الهندسي	English	1		2				3	48	52	100	4.00	B	
		6	UM116	Academic English	الانجليزية الأكاديمية	English	2						3	33	17	50	2.00	S	
						Total	16	0	6	0	3	0	20	395	355	750	30.00	25	

	Semester	No.	Module Code	Module Name in English	اسم المادة الدراسية	Language	SSWL (hr/w)						Exam hr/sem	SSWL hr/sem	USSWL hr/sem	SWL hr/sem	ECTS	Module Type	Prerequisite Module(s) Code
							CL (hr/w)	Lect (hr/w)	Lab (hr/w)	Pr (hr/w)	Tut (hr/w)	Semn (hr/w)							
	Two	1	EL121	fundamental of electrical engineering II	الاسس الكهربائيةII	English	4		2		1		4	109	91	200	8.00	C	
		2	EE122	Mathematics II	الرياضيات II	English	4				1		3	78	72	150	6.00	B	
		3	EE123	Chemistry	الكيمياء	English	2					1	3	33	42	75	3.00	S	
		4	EL124	computer Programming II	برمجة الحاسب الآلي II	English	2		2				4	64	61	125	5.00	C	
		5	EE125	Mechanical Engineering and workshop	الميكانيك و الورش الهندسية	English	3		2		1		4	94	31	125	5.00	B	
		6	UM126	Human Rights	حقوق الانسان	Arabic	2					1	3	33	42	75	3.00	S	
						Total	17	0	6	0	3	2	21	411	339	750	30.00	26	

Level	Semester	No.	Module Code	Module Name in English	اسم المادة الدراسية	Language	SSWL (hr/w)						Exam hr/sem	SSWL hr/sem	USSWL hr/sem	SWL hr/sem	ECTS	Module Type	Prerequisite Module(s) Code
							CL (hr/w)	Lect (hr/w)	Lab (hr/w)	Pr (hr/w)	Tut (hr/w)	Semn (hr/w)							
	Three	1	EL211	Electrical Circuit I	الدوائر الكهربائية I	English	4				1		3	78	72	150	6.00	C	
		2	EL212	Electrical Machine I	المكائن الكهربائية I	English	3				1		3	63	62	125	5.00	C	
		3	EE213	Mathematical iii	الرياضيات III	English	4				1		3	78	47	125	5.00	B	
		4	EL214	Electronics ii	الالكترونيك II	English	2		2		1		4	79	46	125	5.00	C	
		5	EL215	computer Programming	برمجة الحاسوب	English	2		2				4	64	61	125	5.00	C	
		6	EL216	Digital Technical I	التقنيات الرقمية I	English	2				1		3	48	52	100	4.00	C	
						Total	17	0	4	0	5	0	20	410	340	750	30.00	26	

UGII	Semester	No.	Module Code	Module Name in English	اسم المادة الدراسية	Language	SSWL (hr/w)						Exam	SSWL hr/sem	USSWL hr/sem	SWL hr/sem	ECTS	Module Type	Prerequisite Module(s) Code
							CL (hr/w)	Lect (hr/w)	Lab (hr/w)	Pr (hr/w)	Tut (hr/w)	Semn (hr/w)							
	Four	1	EL221	Electrical Circuit II	الدوائر الكهربائية II	English	3				1		3	63	87	150	6.00	C	
		2	EL222	Electrical Machine II	المكائن الكهربائية II	English	3		2		1		4	94	56	150	6.00	C	
		3	EE223	Mathematical III	الرياضيات II	English	3				1		3	63	37	100	4.00	B	
		4	EL224	Electronics II	الالكترونيك II	English	2		2		1		4	79	46	125	5.00	C	
		5	EL225	Electromagnitic fields	مجالات الكهرومغناطيسية	English	3				1		3	63	37	100	4.00	B	
		6	EL226	Digital Technical II	التقنيات الرقمية II	English	2		2		1		4	79	46	125	5.00	C	
						Total	16	0	6	0	6	0	21	441	309	750	30.00	28	

Level	Semester	No.	Module Code	Module Name in English	اسم المادة الدراسية	Language	SSWL (hr/w)						Exam hr/sem	SSWL hr/sem	USSWL hr/sem	SWL hr/sem	ECTS	Module Type	Prerequisite Module(s) Code
							CL (hr/w)	Lect (hr/w)	Lab (hr/w)	Pr (hr/w)	Tut (hr/w)	Semn (hr/w)							
		1	EL311	Electrical Machines I	المكائن الكهربائية I	English	3		2		1		4	94	56	150	6.00	C	
		2	EL312	Electrical Power I	القدرة الكهربائية I	English	3				1		3	63	62	125	5.00	C	
		3	EL313	Communication I	الاتصالات I	English	3				1		3	63	62	125	5.00	C	

Level	Semester	No.	Module Code	Module Name in English	اسم المادة الدراسية	Language	SSWL (hr/w) CL (hr/w)	Lect (hr/w)	Lab (hr/w)	Pr (hr/w)	Tut (hr/w)	Semn (hr/w)	Exam hr/sem	SSWL hr/sem	USSWL hr/sem	SWL hr/sem	ECTS	Module Type	Prerequisite Module(s) Code
		4	EL314	Engineering Analysis I	التحليلات الهندسية I	English	3				1		3	63	62	125	5.00	B	
		5	EL315	Electronics I	الالكترونيك I	English	2		2		1		4	79	46	125	5.00	C	
		6	EL316	Control I	السيطرة I	English	2				1		3	48	52	100	4.00	C	
						Total	16	0	4	0	6	0	20	410	340	750	30.00	26	
UGIII	Semester	No.	Module Code	Module Name in English	اسم المادة الدراسية	Language	SSWL (hr/w) CL (hr/w)	Lect (hr/w)	Lab (hr/w)	Pr (hr/w)	Tut (hr/w)	Semn (hr/w)	Exam hr/sem	SSWL hr/sem	USSWL hr/sem	SWL hr/sem	ECTS	Module Type	Prerequisite Module(s) Code
	Six	1	EL321	Electrical Machines II	المكائن الكهربائية II	English	3		2		1		4	94	56	150	6.00	C	
		2	EL322	Electrical Power II	القدرة الكهربائية II	English	3				1		3	63	62	125	5.00	C	
		3	EL323	Communication II	الاتصالات II	English	3		2		1		4	94	56	150	6.00	C	
		4	EL324	Numerical Anallsis II	التحليلات العددية II	English	3				1		3	63	62	125	5.00	B	
		5	EL325	Electronics II	الكترونيك II	English	3				1	1	3	63	37	100	4.00	C	
		6	EL326	Control II	السيطرة II	English	3				1	1	3	63	37	100	4.00	C	
						Total	18	0	4	0	6	2	20	440	310	750	30.00	28	
Level	Semester	No.	Module Code	Module Name in English	اسم المادة الدراسية	Language	SSWL (hr/w) CL (hr/w)	Lect (hr/w)	Lab (hr/w)	Pr (hr/w)	Tut (hr/w)	Semn (hr/w)	Exam hr/sem	SSWL hr/sem	USSWL hr/sem	SWL hr/sem	ECTS	Module Type	Prerequisite Module(s) Code
	Seven	1	EL411	Power System Analysis I	تحليل انظمة القدرة I	English	3				1		3	63	62	125	5.00	C	
		2	EL412	Power Electronics	الكترونيات القدرة	English	3		2		1		4	94	56	150	6.00	C	
		3	EL413	Information Theory	نظرية المعلومات	English	3				1	1	4	63	62	125	5.00	C	
		4	EL414	Engineering Control III	هندسة السيطرة	English	3		2		1	1	3	94	56	150	6.00	C	
		5	EL415	Electiv(Antenna and Wave propogatin)	اختياري (هوائيات)	English	3				1	1	3	63	37	100	4.00	E	
		6	EE416	Engineering Project	المشروع الهندسي ومنهجية البحث	English	1			2		1	3	48	52	100	4.00	C	
						Total	16	0	4	2	5	4	20	425	325	750	30.0	27	
UGIV	Semester	No.	Module Code	Module Name in English	اسم المادة الدراسية	Language	SSWL (hr/w) CL (hr/w)	Lect (hr/w)	Lab (hr/w)	Pr (hr/w)	Tut (hr/w)	Semn (hr/w)	Exam hr/sem	SSWL hr/sem	USSWL hr/sem	SWL hr/sem	ECTS	Module Type	Prerequisite Module(s) Code
	Eight	1	EL421	Power System Analysis II	تحليل انظمة القدرة II	English	3				1		3	63	62	125	5.00	C	
		2	EL422	Special Machine	المكائن الخاصة	English	3		2		1	1	3	94	56	150	6.00	C	
		3	EL423	Digital Communication	اتصالات رقمية	English	3		2		1	1	4	94	56	150	6.00	C	
		4	EL424	Advanced Electronics	الكترونيك متقدم	English	3				1	1	4	63	62	125	5.00	C	
		5	EL425	Elective (Renewable Energy)	مادة اختيارية (انظمة الطاقة المتجدده)	English	3				1	1	3	63	37	100	4.00	E	
		6	EE426	Engineering Project	المشروع الهندسي و اخلاقيات المهنة	English	1			2		1	3	48	52	100	4.00	C	
						Total	16	0	4	2	5	5	20	425	325	750	30.0	27	
						Total	132	0	38	4	39	13	162	3357	2643	6000	240.0		Must be 240 ECTS

Note: The student should complete 4 weeks of Summer Internships to fullfil the requirements of the Bachelor's degree

Structured SWL (hr/w) type		Module type			SWL: Student Workload
CL	Class Lecture	B	Basic learning activities		
Lab	Laboratory	C	Core learning activity	Structured SWL	
Pr	Practical Training	S	Suport or related learning activity	Unstructured SWL	
Tut	Tutorial	E	Elective learning activity		
Se					

Misan University

First Cycle – Bachelor's degree (B.Sc.) – Electrical Engineering

Table of Contents |

1- Mission & Vision Statemen

Vision Statement

The Electrical Engineering Department is an academic engineering department in a vital and strategic specialization that seeks to graduate engineering cadres specialized in the field of electrical power and machinery engineering with the aim of supporting and developing electrical energy production projects of high level, efficiency and reliability and delivering them to all community facilities and .reducing production costs and energy loss

Mission Statement

To prepare electrical engineering graduates for a career with a wide range of opportunities in design, development and, management.

To promote the intellectual, ethical and technological aspects of the student.

To actively contribute, improve and sustain an environment of continuous learning with professional ability for engineering application in the local market taking into account all possible technical and economic constraints.

2-Program Specification

Programme code:	BSc-ELCE	ECTS	240
Duration:	4 levels, 8 Semesters	Method of Attendance:	Full Time

Electrical engineering is one of the newer branches of engineering, and dates back to the late 19th century. It is the branch of engineering that deals with the technology of electricity. Electrical engineers work on a wide range of components, devices and systems, from tiny microchips to huge power station generators.

Level 1 introduces students to the fundamentals of electrical engineering science and is suitable for progression in all programs within the Electrical Engineering suite of programmes. Core program-specific topics are covered at Level 2 to prepare for the research-led specialized modules at Levels 3 and 4. The University of Missan Electrical Engineering graduate is thus trained to appreciate how research informs teaching, in accordance with the university and college mission statements.

In Level 2, the student learns the basic sciences that qualify him to understand the materials that he will learn about in Levels 3 and 4. The student also learns the basics of specialization courses in electrical engineering, which are power, communications and electronics.

The spirit of research is developed and reinforced from the outset through practical procedures, which are either integrated into lecture units or taught in dedicated practical units such as laboratory experiments conducted by the student in the laboratory. There is a summer training that the student conducts in the field of work in the field of electrical engineering after level 3, which is considered among the graduation requirements for each student, level 4, all students carry out an independent research project, which may be a solution to a practical problem that exists in the scope of work.

Academic tutorials are held at Levels 1 and 2 with the same tutor, who is also the personal tutor, providing continuity and progressive guidance. Level 1 and 2 tutorials include a number of workshops to teach skills, e.g. library use and presentation skills, followed by assessed exercises, e.g. essays and talks, as opportunities to practice these skills in a subject-specific context.

International years and Industrial placements are also offered and individual needs are discussed with the appropriate tutor and accommodated wherever possible.

3-Program Goals

The Electrical Engineering Department in the Faculty of Engineering at Misan University is committed to graduate electrical engineers who will within a four years of graduation:

1-Be able to investigate engineering problems using modern techniques and propose practical solutions.

2-Manage projects and work in multi-disciplinary teams as skilled persona focusing on responsible conduct and professional development.

3-Support the engineering and technological needs of the local society.

4- Taking into account the ethics of the profession.

5- Encouraging students to continue learning after college.

6- Encouraging students on learning and practicing the skills of teamwork.

7- Informing students about the latest developments in electrical engineering field.

4-Student Learning Outcomes

By successfully completing our electrical engineering program, graduates will:

1-an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

2- an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

3- an ability to communicate effectively with a range of audiences

4- an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

5- an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

6- an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions

7- an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Outcome 1

Identification of Complex Relationships

Graduates will be able to illustrate the electrical parts of electrical circuit components and explain how they operate it.

Outcome 2

Oral and Written Communication

Graduates will be able to formally communicate the results of electrical engineering using both oral and written communication skills.

Outcome 3

Laboratory and Field Studies

Graduates will be able to perform laboratory experiments and field studies, by using scientific equipment and computer technology while observing appropriate safety protocols.

Outcome 4

Scientific Knowledge

Graduates will be able to demonstrate a balanced concept of how scientific knowledge develops, including the historical development of foundational theories and laws and the nature of science.

Outcome 5

Data Analyses

Graduates will be able to demonstrate scientific quantitative skills, such as the ability to conduct simple data analyses.

Outcome 6

Critical Thinking

Graduates will be able to use critical-thinking and problem-solving skills to develop a research project and/or paper.

5-Academic Staff

Adel Manaa Dakhil | Ph.D. in Electrical Engineering/power and Machine | Professor
Email:dr.adelmanaa@uomisan.edu.iq
Mobile no.:07715936729

Jabbar Rheem Rashed | Ph.D. in Electrical Engineering /power | Assistant Prof.
Email: dr.jabar72@uomisan.edu.iq
Mobile no.:07731405872

Ahmed Raisan Hussein | Ph.D. in Electrical Engineering/power | Assistant Prof.
Email: alhusseinahmed70@uomisan.edu.iq
Mobile no.:07708861738

Hassinen Abas Hasan | Ph.D. in Communication system | Assistant Prof.

Email: dr-hasanain@uomisan.edu.iq

Mobile no.:07705769213

____

Mohammed Khalaf juma | Ph.D. in Electrical Engineering/power | Assistant Prof.

Email: muhammed.kh@uomisan.edu.iq

Mobile no.:07729245003

____

Sadeq Daeer eneed . | Ph.D. in Electrical Engineering/power | Lecture .

Email: sadeqalmajidi@uomisan.edu.iq

Mobile no.: 07728488869____

Hussein Tuama Hazim | MS.c. in Electrical Engineering/ Communication | Lecture.

Email: Hussein.tuama @uomisan.edu.iq

Mobile no.: '07735717775

____

Ameer Lateef Saleh | MS.c.. in Electrical Engineering/power& Machine | Assistant Prof.

Email: ameer_lateef@uomisan.edu.iq

Mobile no.:0 7707351486

Sinan Imad Sabri | Ph.D. in Computer Engineering | Lecture

Email: sisabri @uomisan.edu.iq

Mobile no.: 07851954898

Haider khalaf jabbar | Ph.D. in Computer Science /AI | Lecture.

Email: Haider.allamy @uomisan.edu.iq

Mobile no.: 07714444600

Thaar Abd alraheem kareem | MS.c.. in Electrical Engineering/ Communication | Lecture

Email: thaar_kareem@uomisan.edu.iq

Mobile no.: 07703200457

Khalid waleed Nasser | MS.c.. in Electrical Engineering/power| Lecture

Email: khalid.waleed @uomisan.edu.iq

Mobile no.: 07702787670

Nawar Saad Erheem | MS.c.. in Electrical Engineering /Electronic& Communication | Lecture.

Email: nawar.alseelawi @uomisan.edu.iq

Mobile no.: 07705595539

Hisham Dawood Salman| MS.c.. in Electrical Engineering/power | Lecture.

Email: hisham.altai@uomisan.edu.iq

Mobile no.: 07723135580

Mohammed hasan Lazim | MS.c. in Electrical Engineering/power | Lecture.

Email: Mohammed.hasan @uomisan.edu.iq

Mobile no.:0 7737663532

Hayder Naser Mnati | MS.c. in Mechanical Engineering | Lecture.

Email: hayderallami @uomisan.edu.iq

Mobile no.:0 7732027899

Maab alaa hussein | MS.c. in Electrical Engineering/Computer | Lecture.

Email: maab-alaa @uomisan.edu.iq

Mobile no.: 07716159795

Rabee hadi hassan| MS.c. in Electrical Engineering/power | Assist Lecture.

Email: rabia.h.h@misan.edu.iq

Mobile no.: 07705601621

Mobile no.: 07719173564

Sarah Kareem Salim| MS.c. in Electrical Engineering/Computer | Assist Lecture.

Email: Sarahalthahabi@uomisan.edu.iq

Mobile no.: 07705601621

Ahmed Majed AbdulAbbas| MS.c. in Electrical Engineering/Computer | Assist Lecture.

Email: ahmedmajidalthahabi@gmail.com

Mobile no.: 07707374139

Zahraa Dawood Hussein | MS.c in Electrical Engineering/power | Assist Lecture.

Email: zahraadawood12@gmail.com

Mobile no.: 07707362078

Haider Abed alkareem Rheem | MS.c. in Civil Engineering/Structure | Assist Lecture.

Email: eng.haider992@gmail.com

Mobile no.: 07712638685

Zahraa Mohsen Kudaeb | MS.c. in Electrical Engineering/ Communication | Assist Lecture.

Email: zahraa.mo.eng @uomisan.edu.iq

Mobile no.:07728290539

Anwer Jabbar Mteer | MS.c. in Computer Engineering/Computer | Assist Lecture.

Email: anwer.jabbar @uomisan.edu.iq

Mobile no.: 07709050208

Mohammed hasson| MS.c. in Electrical Engineering/Computer | Assist Lecture.

Email: mohammedhasson30@gmail.com

Mobile no.: 07710922445

Yasser Ali Kaled| MS.c. in Electrical Engineering/Computer | Assist Lecture.

Email: Yasser.ali534@yahoo.com

Mobile no.: 07707487271

6-Credits, Grading and GPA

Credits

(Name) University is following the Bologna Process with the European Credit Transfer System (ECTS) credit system. The total degree program number of ECTS is 240, 30 ECTS per semester. 1 ECTS is equivalent to 25 hrs student workload, including structured and unstructured workload.

Grading

Before the evaluation, the results are divided into two subgroups: pass and fail. Therefore, the results are independent of the students who failed a course. The grading system is defined as follows:

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:				

Number 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.

Calculation of the Cumulative Grade Point Average (CGPA)

1. The CGPA is calculated by the summation of each module score multiplied by its ECTS, all are divided by the program total ECTS.

   CGPA of a 4-year B.Sc. degree:

   CGPA = [(1st ^{m}odule score x ECTS) + (2nd ^{m}odule score x ECTS) + ……] / 240

7-Curriculum/Modules

Semester 1 | 30 ECTS | 1 ECTS = 25 hrs

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
EL111	fundamental of electrical engineering I	109	91	8	C	
EE112	Mathematics I	78	72	6	B	
EE113	Basic physics	63	62	5	B	
UM114	Computer Programming	64	61	5	S	
EE115	Engineering Drawing	48	52	4	B	
UM116	Academic English	33	17	2	S	

Semester 2 | 30 ECTS | 1 ECTS = 25 hrs

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
EL121	fundamental of electrical engineering II	109	91	8	C	
EE122	Mathematics II	78	72	6	B	
EE123	Chemistry	33	42	3	S	
EL124	computer Programming II	64	61	5	C	
EE125	Mechanical Engineering and workshop	94	31	5	B	
UM126	Human Rights	33	42	3	S	

Semester 3 | 30 ECTS | 1 ECTS = 25 hrs

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
EL211	Electrical Circuit I	78	72	6	C	
EL212	Electrical Machine I	63	62	5	C	
EE213	Mathematical iii	78	47	5	B	
EL214	Electronics ii	79	46	5	C	
EL215	computer Programming	64	61	5	C	
EL216	Digital Technical I	48	52	4	C	

Semester 4 | 30 ECTS | 1 ECTS = 25 hrs

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
EL221	Electrical Circuit II	63	87	6	C	
EL222	Electrical Machine II	94	56	6	C	
EE223	Mathematical IV	63	37	4	B	
EL224	Electronics II	79	46	5	C	
EL225	Electromagnitic fields	63	37	4	B	
EL226	Digital Technical II	79	46	5	C	

Semester 5 | 30 ECTS | 1 ECTS = 25 hrs

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
EL311	Electrical Machines I	94	56	6	C	
EL312	Electrical Power I	63	62	5	C	
EL313	Communication I	63	62	5	C	
EL314	Engineering Analysis I	63	62	5	B	
EL315	Electronics I	79	46	5	C	
EL316	Control I	48	52	4	C	

Semester 6 | 30 ECTS | 1 ECTS = 25 hrs

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
EL321	Electrical Machines II	94	56	6	C	
EL322	Electrical Power II	63	62	5	C	
EL323	Communication II	94	56	6	C	
EL324	Numerical Anallsis II	63	62	5	B	
EL325	Electronics II	63	37	4	C	
EL326	Control II	63	37	4	C	

Semester 7 | 30 ECTS | 1 ECTS = 25 hrs

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
EL411	Power System Analysis I	63	62	5	C	
EL412	Power Electronics	94	56	6	C	
EL413	Information Theory	63	62	5	C	
EL414	Engineering Control III	94	56	6	C	
EL415	Electiv(Antenna and Wave propogatin)	63	37	4	E	
EE416	Engineering Project	48	52	4	C	

Semester 8 | 30 ECTS | 1 ECTS = 25 hrs

Code	Module	SSWL	USSWL	ECTS	Type	Pre-request
EL421	Power System Analysis II	63	62	5	C	
EL422	Special Machine	94	56	6	C	
EL423	Digital Communication	94	56	6	C	
EL424	Advanced Electronics	63	62	5	C	
EL425	Elective (Renewable Energy)	63	37	4	E	
EL426	Engineering Project	48	52	4	C	

8-Contact

Program Manager:

Ahmed Raisan Hussein | Ph.D. in Electrical Engineering | Assistant Prof.

Email: alhusseinahmed70@uomisan.edu.iq

Mobile no.:07708861738

Program Coordinator:

Hussein Tuama Hazim | MS.C. in Electrical Engineering/ Communication | Lecture.

Email: Hussein.tuama @uomisan.edu.iq

Mobile no.: '07735717775

Misan University

First Cycle – Bachelor's Degree (B.Sc.) - Electrical Engineering

Table of Contents

1. Overview

This catalogue is about the courses (modules) given by the program of Electrical Engineering to gain the Bachelor of Science degree. The program delivers (42) Modules with (6000) total student workload hours and 240 total ECTS. The module delivery is based on the Bologna Process.

2. Undergraduate Courses 2023-2024

Module 1

Code	Course/Module Title	ECTS	Semester
EL111	fundamental of electrical engineering I	8	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	3	109	91
Description			
The course "DC Electrical Circuits" is designed for undergraduate students pursuing studies in electrical engineering or related disciplines. This course provides a comprehensive introduction to the fundamental principles and concepts of direct current (DC) circuits. It lays the foundation for understanding electrical circuits and serves as a prerequisite for more advanced courses in electronics and circuit analysis. Understand Basic Electrical Concepts: Students will develop a solid understanding of electrical quantities such as voltage, current, resistance, power, and energy, and learn how these concepts relate to DC circuits. Analyze DC Circuits: Students will learn techniques to analyze and solve DC circuits using Ohm's law, Kirchhoff's laws, and various circuit analysis methods. They will gain proficiency in calculating voltages, currents, and power dissipation in series, parallel, and combination circuits. Apply Circuit Laws: Students will apply fundamental circuit laws and theorems, including Ohm's law, Kirchhoff's voltage and current laws, Thevenin's theorem, and Norton's theorem to simplify and solve complex DC circuits.			

Module 2

Code	Course/Module Title	ECTS	Semester
EE112	Mathematics I	6	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	1	78	72
Description			
This course gives the students the basics on Linear equations and matrices; functions, limits and continuity; vector geometry; differentiation; applications of differentiation; integration; and applications of integration, including an introduction to first order differential equations. After successful completion of this course.			

Module 3

Code	Course/Module Title	ECTS	Semester
EE113	Basic physics	5	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	62
Description			
Many essential topics were explained like the Atom, Models, Wave nature of light and Heisenberg's uncertainty principle. Explaining the properties of electrical, mechanical and magnetic of the materials. Explaining semiconductor materials and its applications. Then, different structures and applications were discussed about different diodes. Explaining the atomic structure of Bipolar Junction Transistor (BJT) with its applications. Explaining the atomic structure of the Field Effect Transistor (FET) and the Metal-Oxide-Semiconductor Field-Effect Transistor (MOSFET). Different applications of FET and MOSFET were demonstrated. The main objectives of the course, is to develop an understanding of Energy levels & atomic structure with the electrical and magnetic properties of metals. Also, an understanding the properties of semiconductors were discussed with their applications. After that different types of diode structure were developed with their applications. Lastly, BJT, FET and MOSFET transistors were demonstrated with their applications.			

Module 4

Code	Course/Module Title	ECTS	Semester
UM114	Computer Programming	5	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	64	61
Description			
The module provides thorough introduction to the C programming language. The first two weeks will cover basic syntax and grammar and expose students to practical programming techniques. The remaining lectures will focus on more advanced concepts, such as Data input and output, functions, Scope rules and storage classes, Arrays and strings, math and logical operations, Command line arguments., library development and usage. Daily programming assignments and weekly laboratory exercises are required. Knowledge of C is highly marketable for summer internships, and full-time positions in software and embedded systems development.			

Module 5

Code	Course/Module Title	ECTS	Semester
EE115	Engineering Drawing	4	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	2	48	52
Description			
Engineering drawing is the technical language between engineers; therefore, this course intends to make the students fluent in the fundamentals of this unique language. The course includes applying those fundamentals through AutoCAD while teaching its interface, 2D and 3D tools, options, electronic library, and exporting, importing files of drawings and printing them. The production of two-dimensional drawings and layouts for the design and manufacturing of general engineering systems and special electrical applications is the crucial purpose of this course. The course also includes the basics of three-dimensional isometric and oblique engineering drawing and AutoCAD three-dimensional drawing. The student will be able to draw and deal the and with different types of design layouts and working drawings, through learning the rules of creating and reading writings and measurements on the drawings. The course also includes introduction to work with AutoCAD Electrical and using its advanced electronic library.			

Module6

Code	Course/Module Title	ECTS	Semester
UM116	Academic English	2	1
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0	33	17
Description			
This course is intended for Engineering students studying at Electrical Engineering department- Faculty of Engineering- University of Kufa. This course aims at improving the student ability to read and understand the textbook and lectures that are delivered in English and lies within electrical engineering major. This is achieved through two stages. At the beginning of this course, an intensive review of English tenses and grammar will be delivered to the student with several examples. In the second stage, multiple articles rich with engineering vocabulary are introduced and explained to the students. In both stages, the student progress will be assessed through several quizzes, assignment and examinations.			

Module7

Code	Course/Module Title	ECTS	Semester
EL121	fundamental of electrical engineering II	8	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	3	109	91
Description			
Analysis of single phase A.C circuits: reactance and impedance, conductance – suspactance and admittance, the phasor diagram, series – parallel – and series / parallel circuits, power calculation in A.C circuits, power factor & power factor correction. Complex number & its application to A.C circuits: Equivalent impedance : series – parallel – series / parallel – delta and star connections introduction to network theorems, Kirchoff's laws : KVL – KCL, Maxwell s circulating currents (mesh analysis) nodal analysis, super position theorem, Thevenin's theorem, Nortons theorem, maximum power transfer theorem, Millman's theorem, substitution theorem, reciprocity theorem, power calculation (complex power). Resonance: resonance: quality factor – selectivity – half power – frequency and bandwidth, parallel resonance: quality factor – selectivity – half power – frequency and bandwidth, series / parallel resonance circuits. Magnetic circuit,Magnetic field, direction of magnetic field, characteristics of lines of magnetic field , magnetic field due to electric, magnetic field in a coil, force in current carrent carrying conductor			

across a magnetic field, left hand rule, magnitude of the force, electromagnetic induction, faraday s law, right hand rule, magnitude of induced e.m,f magnitude of e.m.f. in a coil, mmf a magnetic field strength, magnetic constants, reluctance, magnetic leakage and fringing, magnetic factors, magnetic circuit: series – parallel and series / parallel , kirchoff ,s laws for magnetic circuit, hysteresis and factors on its loop, hysteresis loss and eddy current loss, condition for minimum volume of a permanent magnet, load line of a permanent magnet, force between two magnetic poles, magnetic pull between two iron surfaces

Module8

Code	**Course/Module Title**	**ECTS**	**Semester**
EE122	Mathematics II	6	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	1	78	72
Description			
The following topics will be covered in this course: • Partial differentiation, chain rule, gradient, directional derivatives, tangent planes, Jacobian, differentials, line integrals, divergence and curl, extreme values and Lagrange multipliers. • Second order linear differential equations and their applications. • Fourier series. • Double and triple integrals: elements of area, change of order of integration, polar coordinates, volume elements, cylindrical and spherical coordinates. • Eigenvalues and eigenvectors and their applications. • Laplace transforms. • Statistics: approximating expectations, characteristic functions, random vectors (joint distributions, marginal distributions, expectations, independence, covariance), linking data to probability models (sample mean and variance, order statistics and the empirical distribution function, convergence of random variables, law of large numbers and point estimation, the central limit theorem, error bounds and confidence intervals, sample size calculations, likelihood).			

Module9

Code	Course/Module Title	ECTS	Semester
EE123	Chemistry	3	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0	33	42
Description			
Electric conductance in Electrolytes: Ability of electrolytes to conduct electricity based on the movement of charged particles in the solution due to the presence of ions. Measurements of Conductivity of Electrolytes: Measuring the electrical conductivity of electrolytes by passing an electric current through it, using two electrodes placed in the solution. The degree of Dissociation of Electrolytes in Solution: A measure of the degree to which an electrolyte solute dissociates into ions in solution, expressed as a fraction or percentage. Transference number of Ions: Fraction of total current carried by a specific ion in a solution containing multiple ions, used to calculate ion transport rates and predict solution behavior. Oxidation and Reduction: Processes where an atom or molecule loses or gains electrons, respectively. Critical in energy conversion, biological processes, and industrial processes such as corrosion and metallurgy.			

Module10

Code	Course/Module Title	ECTS	Semester
EL124	computer Programming II	5	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	64	61
Description			
This semester includes the following topics: Introduction to MATLAB, Creating Variables, Some Useful MATLAB Functions, Data Types. Script Files. Introduction to Arrays Graphing. Input Statements Output Statements. Conditional Statements: Logical Operators, Conditional Statements: if, else, and else/if, Conditional Structures: Switch..Repetition Structure: Introduction to Loops Repetition Structure: For Loops Repetition Structure: While Loops. Nested Loops Breaks, Repetition Structures: Nested Loops and the Break Statement.			

Module11

Code	Course/Module Title	ECTS	Semester
EE125	Mechanical Engineering and workshop	5	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	3	94	31
Description			
Static,Force system, units system, parallelogram law, force+ components, resultant of coplanar forces, components of force in space, moment of a force, moment of coupler, equilibrium, free body diagram, coplanar system, analysis of trusses, friction, nature of friction, theory of friction, coefficient of friction, centroids and center of gravity, centroids of area, centroids determined by integration, moments of inertia, parallel axes theorem, 2nd moment of area by integration, radius of gyration, moment of inertia of composite area. Dynamics: Kinetics of particle, rectilinear motion, curvilinear motion, rectangular components of curvilinear motion, normal and tangential component of acceleration, kinetics, force, mass and acceleration, kinetic of particle Newton's 2nd law. Thermodynamics: Introduction, active and their specifications, work and heat in ideal gasses and steam 1st law of thermodynamics, practical law in steam and gasses, 2nd law of thermodynamics practical law in steam and gasses. Strength of Materials:Hook's law, tension and compression stress, thin-walled cylinders and spheres, combined stress (Mohr's circle) shear and normal stress, stress in beams (initial principal). *Workshop Skills The workshop training program is designed to satisfy the following: Objectives Teaching safety rules and regulations on-site in an industrial environment proper use of working tools, instruments, and machines, introducing basic workshop practices, production, labor, and time-requirements of workshop operations. The students are introduced to training programs in six workshops: welding, forging, turning and milling, carpentry, and casting. The student is to spend 4 hours of training in every workshop			

Module12

Code	Course/Module Title	ECTS	Semester
UM126	Human Rights	3	2
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	0	33	42
Description			
Introduces students to the philosophic and political background of the concept of human rights. Discusses important documents as part of the history of the development of human rights theories. Examines important issues in current political and ethical debates about human rights. Reviews core legal documents and the work of the most important governmental and nongovernmental institutions currently involved in human rights protection and promotion. Examines at least one current problem area in human rights protection			

Module13

Code	Course/Module Title	ECTS	Semester
EL211	Electrical Circuit I	6	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	1	78	72
Description			
This semester includes the following topics, Sinusoidal Steady State Analysis Sinusoidal analysis and phasor, mesh and nodal ac analysis, Thevenin and Norton ac analysis, superposition ac analysis, AC power calculation. S- domain Circuit Analysis ,Impedance and admittance in s-domain, circuit analysis in s-domain The Transient Circuits , RC, RL, RLC circuit in series and parallel and their complete response. Poly-phase Circuits , Single-phase three wire system, 3-phase balance and unbalance systems with star and delta connections, power in 3-phase circuits.			

Module14

Code	Course/Module Title	ECTS	Semester
EL212	Electrical Machine I	5	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	1	63	62
Description			
This section includes a description of the module, DC Machines: General principle of rotating electrical machines, and calculation of induced emf, energy, power, and torque in DC machines, constriction of DC machines, and function of commutator, type of armature windings calculation of mmf per pole, type of excitation connections, armature reaction, commutation, type and characteristics of DC generators, parallel operation of DC generators, losses and efficiency of DC machines. Motors: Principle of operation of DC motors, calculation of speed, calculation of torque, starting of DC motors, characteristics of DC motors and their type, speed control of DC motors & electric breaking, testing of a DC machines.			

Module15

Code	Course/Module Title	ECTS	Semester
EE213	Mathematical iii	5	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
4	1	78	47
Description			
This section includes a description of the module, Vector; scalars and vectors, component of a vector, rules of vector arithmetic, norm of a vector, normalizing of vectors, dot product, cross product, product of three or more vectors, equations of lines in space, planes in 3-space. Vector-valued functions: limits and continuity, derivatives, forms of a curve equation in space, parametric representation, unit tangent and normal vectors, curvature, radius of curvature, motion along a curve, velocity, acceleration and speed, normal and tangential components of acceleration. Partial differentiation: Function of two or more variables, limits and continuity, partial derivatives, partial derivatives of functions of two variables, partial derivatives of functions with more than two variables, the chain rule, the chain rule for derivatives, the chain rule for partial derivatives, directional derivatives and gradients, directional derivatives, the gradient, tangent plans and normal vectors, maxima and minima of functions of two variables, Lagrange multipliers. Multiple integrals: Double integral, areas and volumes, double integral in polar coordinates, parametric surfaces, surface area, surface integrals, evaluation of volume and triple integral.			

Module16

Code	Course/Module Title	ECTS	Semester
EL214	Electronics ii	5	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	46
Description			
This section includes a description of the module, Amplifier design: Characteristics and properties of a linear amplifier, voltage gain, current gain, power gain, dB scale, frequency domain characteristics, distortion, Definition of small-signal in transistor, Bias circuits for linear amplification, voltage, current, power gain, input/output resistances, Amplifier configurations: BJT common-emitter, common-base and common-collector, MOSFET common-source, common gate, Common drain. Differential and Multistage Amplifiers: The MOS differential pair: small signal operation, The BJT differential pair, the differential amplifier with active load, Multistage amplifiers (voltage gain, current gain, etc.…), types of multistage amplifiers (cascade, … etc..) Others Two-Terminal Devices: Schottky Diodes, Power diodes, Photoconductive Cells, IR Emitters, Liquid-Crystal Displays, solar cells. pnpn and other Devices:Description and operation of silicon controlled rectifier, Diac, Thyristor, GTO, and Triac, Unijunction transistor, phototransistors, opto-isolators, programmable unijunction transistor.			

Module17

Code	Course/Module Title	ECTS	Semester
EL215	computer Programming	5	3
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	2	64	61
Description			
This section includes a description of the module, When studying Python, you will cover a variety of topics and concepts that will help you gain a solid understanding of the language and its applications Syntax: Learn the basics of Python syntax, including data types, variables, operators, loops, conditional statements, functions, and exception handling. Data Structures: Manipulate and iterate over built-in data structures like lists, tuples, sets, and dictionaries. Object-Oriented Programming: Understand classes, objects, inheritance, encapsulation, and polymorphism to create reusable and modular code File Handling: Open, read, write, and manipulate files, and handle exceptions that may occur during file operations. Data Analysis and Visualization: Process, manipulate, analyze, and visualize data using libraries like NumPy, Pandas, and Matplotlib. Algorithms and Problem Solving: Implement algorithms and solve problems using common data structures like sorting, searching, graphs, and trees.			

Module18

Code	Course/Module Title	ECTS	Semester
EL216	Digital Technical I	4	3
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, Standard forms Digital Logic Gates, Introduction to Digital Techniques: Basic Definitions, System of Numbers, General number formula: Binary, octal, decimal and hexadecimal numbers.Numbers Base Conversion: Arithmetic operations in different number system, complements, binary codes, BCD, Ex-3, Gray codes. Boolean Algebra , Basic definitions, basic theorem and properties, Boolean functions. Canonical and conditions. Karanough Maps: AND- OR implementation, don't care			

Module19

Code	Course/Module Title	ECTS	Semester
EL221	Electrical Circuit II	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	87
Description			
This section includes a description of the module, Transfer Function poles and zeros of transfer functions, natural response and s-plane. Two-Port Networks, y-z-h and ABCD parameters, attenuation and phase functions, loss of networks. Coupling Circuits. Magnetic coupling, coefficient of coupling, equivalent circuits linear, ideal transformers auto transformer Filters, Constant k-filters, low pass and high pass, modern filter design, Butterworth and Chebyshev filters, network transformations and all pass filters. Introduction to Measurement: Measurement units and standards of measurements Instrument Types and Performance Characteristics: Review of instrument types, static & dynamic characteristics.Errors during measurement process: Source of errors and reduction of errors. Measurement Noise and Signal Processing:Sources of measurement noise, techniques for reducing measurement noise, and introduction to signal processing. Electrical Indicating and Test Measurement:Digital meters (voltage to time conversion type, potentiometric type, dual slope integration type, voltage to frequency type and multi-meters), analog meters (electrodynamic type, clamp-on meters, and thermocouple meter), cathode ray oscilloscope and digital storage oscilloscope.			

Module20

Code	Course/Module Title	ECTS	Semester
EL222	Electrical Machine II	6	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	3	94	56
Description			
This section includes a description of the module, Transformer type and construction, transformer action, Faraday's and Lenze's law's, transformer general equation, voltage ratio, current ratio, power rating equations, volt per turn form general equation volt per turn in terms of power rating., losses in transformer, equations of these losses relating to transformer variables as a function to frequency and voltage (eddy current loss and hysteresis loss), tapping of transformer, regulation calculation using voltage values, equivalent circuit of the transformer, leakage reactance, equivalent resistances, reactance's, and impedances, phasor diagrams, short circuit test and open circuit test, regulation calculation using short and open circuit tests, power rating related to window and core area of transformer, efficiency calculation using short and open circuit tests, maximum efficiency, all day efficiency, short circuit times as related current rating, transformer polarity, parallel operation of transformers, three phase transformers, connection of three phase transformers, importance of connecting transformer neutral to the earth, phasor groups, zig-zag transformer, voltage grading of transformer, harmonics in transformer, auto transformers and their types, calculation of power rating of auto transformers.			

Module21

Code	Course/Module Title	ECTS	Semester
EE223	Mathematical III	4	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	37
Description			
This section includes a description of the module, Differential Equations: First Order: variable separable, exact, linear, Bernoulli. second and Higher Order: Linear equation with constant coefficients, linear homogeneous equations with constant coefficients, non-homogenous equations, solving of non-homogenous equations, variation of parameters, higher order linear equations with constant coefficients, D-operator, Cauchy equation. Fourier series, Periodic and non- Periodic Functions, Euler Formulas, Even and Odd functions, Half Range Expansion(Fourier Sine and Fourier Cosine), Complex Fourier Series (Exponential), Applications of Fourier Series in Electric Circuits. Sequences and series, Convergence and Divergence Test, Geometric Series and Partial Sum, Integral, Comparison, Ratio and Root Tests, Alternating series, Power Series, Taylor and Maclaurin Series, Applications of Power Series.			

Module22

Code	Course/Module Title	ECTS	Semester
EL224	Electronics II	5	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	46
Description			
This section includes a description of the module, Frequency Response: Low frequency response of the CS and CE amplifiers, internal capacitive effects and the high frequency model of the MOSFET and the BJT, high frequency response of CS and CE amplifiers, high frequency response of the CG and cascade amplifiers, high frequency response of source and emitter followers, high frequency response of differential amplifiers, other wideband amplifier configurations. Feedback Amplifier: Feedback concepts, types, effects and topologies, feedback analysis, voltage-series, voltage shunt, current –series, and current-shunt, F.B. stability and response of feedback amplifiers. Power Amplifiers : Series-fed class A amplifier, transformer-coupled Class A amplifier, class B amplifier, amplifier distortion, power transistor heat sinking, class AB and push-pull amplifiers, class C and class D amplifiers.			

Module23

Code	Course/Module Title	ECTS	Semester
EL225	Electromagnitic fields	4	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	37
Description			
This section includes a description of the module, The Cartesian coordinate system, vector components and unit vector field, dot product, cross product, circular cylindrical coordinates system, spherical coordinate system. Coulombs Law and Electric Field Intensity The experimental law of Coulomb, electric field intensity-field of n-point charges, field due to a continuous volume charge distribution, field of line charge, field of sheet of charge, stream line and sketches of fields, electric flux density. Electric Flux Density, Gauss's Law, and Divergence Electric flux density, Gauss's law-application of Gauss's law, differential volume element divergence, Maxwell's first equation, Vector operator. Energy and Potential , Energy and potential energy expended in moving a point charge, the line integral – definition of potential difference and potential, the potential field of point charge, the potential field of system charge, conservative property, potential gradient, the dipole, energy density in the electric field. Conductor, Dielectrics, Capacitance current and current density, continuity of current, metallic conductors, conductor properties and boundary condition, the method of images, semiconductors, nature of dielectric material, boundary			

condition for perfect dielectric materials, capacitance, several capacitance examples, capacitance of a two-wire line. Poissson's and Laplace's Equations: Poisson's & Laplace's equations, Uniqueness theorem, examples of the solution of Laplace's equation (1D), examples of the solution of Poisson's equation (1D), product solution of Laplace's equation. The Steady Magnetic Field Boit – Savart law, amperes circutal law, Curl, Stocke's theorem, magnetic flux and magnetic flux density. The Scalar and Vector Magnetic Potential Derivation of steady – magnetic field laws, magnetic forces. Magnetic Forces, Materials and Inductance Force on moving charge, force on differential current element, force between differential current elements, force and torque on a closed circuit. The Nature of Magnetic Materials Magnetization and permeability, magnetic boundary conditions, the magnetic boundary condition, the magnetic circuit, potential energy and force on magnetic materials, inductance and mutual inductance.

Module24

Code	**Course/Module Title**	**ECTS**	**Semester**
EL226	Digital Technical II	5	4
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	46
Description			
This section includes a description of the module, Adders Arithmetic Operations: Subtractions, half and full adders and subtractions, binary parallel address. Code Conversion: Even and odd party logic, decoders, encoders, comparators, multiplexers and DE multiplexers. Sequential Logic: Flip-flops (RS, T, D, JK, …), master slave FF, counters, shift registers. Memory design.			

Module25

Code	Course/Module Title	ECTS	Semester
EL311	Electrical Machines I	6	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	3	94	56
Description			
This section includes a description of the module, Three-Phase Induction Motors: Construction and principle of operation, equivalent circuit, torque-speed characteristics, starting and maximum torque, phasor and circle diagrams, starting of 3-phase induction motor, speed control of 3-phase induction motor, braking of 3-phase induction motor, induction generator. Single Phase Induction Motor: Types of single-phase induction motors, analysis of single phase IM using double revolving field theory, characteristics and windings of single phase IM, circle diagram, analysis of combined winding performance using revolving field theory, symmetrical components analysis, MMF components and components eliminations, general equivalent circuit and particular cases.			

Module26

Code	Course/Module Title	ECTS	Semester
EL312	Electrical Power I	5	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	62
Description			
This section includes a description of the module, Sources of Electrical Energy : Structure of power system and its elements, major sources of primary energy, power stations, steam, hydro, gas turbines, nuclear, M.H.D generation, renewable energy sources, solar energy, wind generators, other renewable sources, AC and DC single and 3-phase transmission, development of electric power in Iraq. Mechanical Design of Transmission Lines: Conductor materials, line supports, sag, calculation of sag, effect of wind and ice, insulators, voltage distribution over an insulator string, string efficiency, improving string efficiency. Transmission Line Parameters: Line resistance, line inductance, single-phase line with multi-conductors, bundling, line inductance of three-phase transmission systems, single-phase and three-phase capacitance. Electrical Characteristics of Overhead Transmission Lines Representation of lines, short, medium, long T.L., the equivalent circuit of a long transmission line, power factor flow through a transmission line, power circle diagram, line regulation, reactive compensation of transmission line. Corona: Phenomenon, disruptive critical voltage, visual critical voltage, corona losses, factor and conditions affecting corona losses.			

Underground Cables: Conductor materials, insulating materials, sheathing end armouring materials, types of cables, insulation resistance, stress and capacitance, use of inter sheaths, capacitance grading, power factor in cables, capacitance in three core cables, thermal characteristics, comparison between overhead lines and underground cables.

Module27

Code	Course/Module Title	ECTS	Semester
EL313	Communication I	5	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	62
Description			
This section includes a description of the module, Communication system elements (signal analysis) Signal classification of periodic and non-periodic signal, Fourier series and Fourier transform, Classification of system ,power spectral density, correlations Noise: Types, power calculation, thermal white Gaussian noise (AWGN), BAND-LIMITED noise(base band and band pass), Noise through linear systems. Linear modulation: AM/DSB-LC, AM/DSB-SC, AM/SSB-SC, AM/VSB, Noise in AM System, Frequency division multiplexing (FDM), commercial receivers(TRF and super-heterodyne), and noise in AM systems. Angle Modulation:NBFM, NBPM, WBPM, Noise in angle modulation systems			

Module28

Code	Course/Module Title	ECTS	Semester
EL314	Engineering Analysis I	5	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	62
Description			
This section includes a description of the module, Fourier Transform: Properties convolution theorem, power spectral, density and correlations, signals and linear systems, applications. The Z-Transform : Region of convergence, properties of Z-transforms, Z-transform pairs, the inverse of Z transform, analysis and discrete-time systems, applications. Complex Variable Theory: Functions of complex variables, complex differentiation, analytic functions and its properties, integration in the complex plane, Cauchy's theorem, Cauchy's integral formula for simply and multiply connected regions, Taylor's and Laurent series, the residue theorem. Solution of Differential Equations using power series Legendre's equation, Legendre's polynomials, Bessel functions of the first and second orders, Bessel function properties. Partial Differential Equations: Wave equation, Laplace equation, solution of boundary condition problems, general solution, solution by separation of variables.			

Module29

Code	Course/Module Title	ECTS	Semester
EL315	Electronics I	5	5
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
2	3	79	46
Description			
This section includes a description of the module, Operational Amplifiers: The ideal OP amplifier, the inverting configuration, the non-inverting configuration, difference amplifiers, integrators and differentiators, DC imperfections, effect of finite open loop gain and bandwidth on circuit performance, large signal operation of OP Amps, the 741 OP-Amp circuit, some OP Amp applications. Active Filters: Filters concept, types, direct realization approach, simulated inductance methods, variable frequency, scaling methods, state variable filter, cascading realization approach, single operation amplifier structures, voltage controlled voltage source circuits, multiple loop feedback circuits. Oscillators: Oscillator concepts, Low frequency oscillators, RC-phase shift oscillators, Wien-bridge oscillators, High frequency oscillators, Hartley oscillators, Colpitts oscillators, Clapp and Meissner oscillators, Negative resistance oscillators, Crystal oscillators. Voltage and Current Regulators Zener diode stabilizers, line regulation, voltage regulators, series regulators, shunt regulators, switching regulators, current regulators, typical current, grounded load C.R. Analogue Multiplexers: Analogue multiplier operation, characteristics and applications. Analogue Multipliers: Logarithmic multiplier, quainter-square multiplier, triangle-averaging multiplier, time division multiplier, current rationing multiplier.			

Module30

Code	Course/Module Title	ECTS	Semester
EL316	Control I	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, Introduction and review: Systems, plant, linear dynamical systems, open loop and closed loop (feedback) systems. Modeling of Control Systems: Mathematical model of electrical systems, electromechanical systems, block diagrams, signal flow graph, Mason's rule. Mathematical model of electrical systems, electromechanical systems, block diagrams, signal flow graph, Mason's rule. Time domain analysis: Response of 1St order systems, response of 2nd order systems, step response analysis and performance specifications, static and dynamic error coefficient. Stability Analysis: Stability of dynamical systems, the Routh-Hurwitz stability criterion, root locus analysis.			

Module31

Code	Course/Module Title	ECTS	Semester
EL321	Electrical Machines II	6	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	3	94	56
Description			
This section includes a description of the module, Synchronous Machines Alternators, construction, salient and non-salient pole types, linear and non-linear analysis of cylindrical rotor, salient-pole machines (two-reactance and general methods),E.M.F. equation, armature reaction equation, power, parallel operation of synchronous generators, performance of generator connected to infinite-bus, V-curves, synchronous motor, method of starting, phasor diagram and equivalent circuit, hunting of synchronous machine.			

Module32

Code	Course/Module Title	ECTS	Semester
EL322	Electrical Power II	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	62
Description			
This section includes a description of the module, Distribution System Configuration: Various distribution system circuit components, representation and parameters radial, ring, spike, spindle, and interconnected systems. Electrical Design of Distribution Systems: Voltage level, selecting various system components, transformers, cables, overhead lines, switching and protective gear, voltage drop & power loss calculations, economic considerations. Distribution inside Large Buildings: Single rising mains, individual floor supply, ring supply, double feed and grouped supply, vertical and horizontal supply systems, main, sub main, and final distribution boards. Industrial Power Distribution: Special features, equipment layout, cable trenches, cable trays, Grounding, emergency power supply. Reactive Power Control in Distribution Systems: Individual, grouped, and centralized compensation, advantages, size and location of reactive power control equipment. Electrical Load Management: Objectives, devices controlled various methods of load control, practical implementation problems.			

Module33

Code	Course/Module Title	ECTS	Semester
EL323	Communication II	6	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	3	94	56
Description			
This section includes a description of the module, Digital communication , Nyquist sampling theorem, pulse modulation PAM, PWM, PPM, time division multiplexing (TDM), Noise in pulse modulation ,pulse code modulation PCM/TDM, data modulation (DM), quantization noise in PCM and DM, signaling format (unipolar , bipolar , and spilt- phase Manchester), sinusoidal digital modulation ASK, PSK, FSK, noise in ASK, PSK, FSK, (error probability using coherent matched filter and noncoherent detection) Transmission line: Equivalent circuit, characteristic impedance , phase velocity ,reflection coefficient, standing wave,quarter-wave transformer, smith chart calculation and stub matching.			

Module34

Code	Course/Module Title	ECTS	Semester
EL324	Numerical Anallsis II	5	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	62
Description			
This section includes a description of the module, Introduction: Why numerical methods, Solution of non-linear equations (roots finding): graphical method, bisection method, method of iteration, Newton's method, the secant method. Solving sets of linear equations: Matrix notation, Gaussian elimination method, evaluation of the inverse of a matrix, matrix inverse method, LU factorization method, Gauss-Seidel iteration method, Eigen values and Eigen vectors. Solving set of set of nonlinear equations. Numerical interpolation: Polynomial interpolation, linear interpolation, quadratic interpolation, higher degree interpolation (LaGrange's interpolation), error in polynomial interpolation. Numerical differentiation and integration: Derivatives from interpolating polynomials, trapezoidal & Simpson's rules for numerical integration. The Role of Statistics in Engineering , Descriptive Statistics, Probability, Discrete Random Variables and Probability Distributions, Continuous Random Variables and Probability Distributions Joint Probability Distribution, Sampling Distributions and Point Estimation of Parameters . Statistical Interval for a Single sample			

Module35

Code	Course/Module Title	ECTS	Semester
EL325	Electronics II	4	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	37
Description			
This section includes a description of the module, Integrated Circuit Technologies , Basic operational characteristics and parameters, CMOS Circuits, TTL Circuits, practical considerations in the use of TTL, comparison of CMOS and TTL performance, Emitter coupled logic (ECL) circuits, BiCMOS digital circuits, PMOS, NMOS, and E2MOS. Memory Circuits: Semiconductor memories: Types and architectures. Programmable Logic Devices FPD (Field Programmable Device), PLD (Programmable Logic Device), PLA (Programmable Logic Arrays), PAL (Programmable Array Logic), SPLD/CPLD (Simple/Complex Programmable Logic Device), GAL (Generic Array Logic), PLD Programming, ASIC, Digital System Applications, and introduction to the FPGA. Linear Digital ICs: Introduction, comparator unit operation, D/A convertors (Binary weighted D/A converters, R/2R D/A converters, IC D/A converters), A/D convertors (parallel encoded A/D converters, counter ramped A/D converters, successive approximation A/D converters, IC A/D converters), Timer IC unit (astable, monostable and bistable using 555 timer), Voltage controlled oscillator, Phase locked loop, interfacing circuitry.			

Module36

Code	Course/Module Title	ECTS	Semester
EL326	Control II	4	6
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	37
Description			
This section includes a description of the module, Frequency domain Analysis: Frequency domain analysis, the Bode diagram, the stability in frequency domain, the Nyquist stability criterion. Lead compensation, lag compensation, lead-lag compensation. State space analysis: Mathematical modeling of dynamic systems in state space (Mechanical and Electric systems), transfer functions, Diagonalization, Eigen values and Eigen vector, determination of State Transition Matrix, solution of state equations, Carley -Hamilton Theorem, Controllability and Observability. Design of Control Systems in State Space: Pole-placement, State observers (Full, reduced and minimum types), design of servo systems. PID Control Design: Tuning rules for PID controllers, PID control of plants, Ziegler-Nichols rules, Modifications of PID control schemes. System sensitivity, two degree of freedom control, the design of robust control systems.			

Module37

Code	Course/Module Title	ECTS	Semester
EL411	Power System Analysis I	5	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	62
Description			
This section includes a description of the module, Per-Unit Systems Node equations, synchronous machines in power plant. Fault Calculations: Symmetrical three-phase faults, symmetrical components (symmetrical components of unsymmetrical phasors, power in terms of symmetrical components, sequence impedance of sequence networks, +ve, -ve, and zero sequence networks, unsymmetrical faults on power systems. Load Flow Solutions: Gauss-Seidel method, Newton- Raphson method, data for load flow studies, practical power flow problems utilizing computer algorithms. Power System Stability: Stability problem, dynamics of synchronous machines, swing equation, power angle equation, steady state stability, transient stability, equal area criterion, numerical solution of swing equation, multi-machine stability, computer program of transient stability, design methods for improving transient stability. Effect of fault on stability, Stability study of typical Power systems			

Module38

Code	Course/Module Title	ECTS	Semester
EL412	Power Electronics	6	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	3	94	56
Description			
This section includes a description of the module, Introduction: Principle devices and characteristics: diode, power transistor, thyristor (SCR), GTO and triac, SCR dynamic properties at switching ON and OFF. Methods of SCR turning ON, turning OFF and protection, trigger circuit design, series and parallel operation of SCR, cooling. Rectifiers: Uncontrolled, half and full controlled, half and full wave rectifiers, single phase half wave, biphase, bridge, 3-phase half wave and bridge, and p-pulse rectifiers, effects of FWD, Specifications of devices and transformers. Converter Operation: Overlap, principls,2 pulse, 3 pulse, p pulse and bridge converters, FWD overlap, power factor and effects of overlap, regulation, inversion and delay angle control.DC Line Commutation and Choppers: Inverter classifications, forced commutations and parallel capacitors, step down choppers, step up choppers. Inverters: Analysis of single phase bridge and center tapped source inverters, square and quasi-square wave output, operation of 3-phase bridge inverter, square and quasi-square wave output, inverter voltage and frequency control technique. Cyclo-converters: Principles, circulating currents and blocked group operations, types and applications. Single Phase AC Voltage Controllers: AC regulators, transformer tap changers, control of multi-winding transformers, integral cycle control.			

Module39

Code	Course/Module Title	ECTS	Semester
EL413	Information Theory	5	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	62
Description			
This section includes a description of the module, Information theory Self –information, source entropy and source entropy rate ,mutual information, channel model BSC and TSC ,joint and condition entropies, capacity and efficiency of symmetric and non-symmetric discrete channel , optimum threshold setting of continuous channel (Shannon equation) . Coding of Discrete Sources: Efficiency and redundancy of code , fixed length codes, variable length codes, fanao code, Huffman code, Shannon code, nonbinary source coding, source extension for higher coding efficiency. Channel Coding: Even and odd parity error detection codes, probability of undetected errors. Error correction codes , linear block codes (generator and parity check matrices), hamming distance ,hamming weight hamming bound , and error correction capabilities.Decoding of linear block codes(syndromes). Cyclic codes: generator polynomial, nonsystematic code(multiplication),systematic cyclic code(division), and realizing logic circuit for encoding and decoding of systematic cyclic codes . Convolution codes,encoding logic (generation), tree diagram, static diagram and trellis diagram of convolution code . Decoding of convolution code using Viterbi algorithm.			

Module40

Code	Course/Module Title	ECTS	Semester
EL414	Engineering Control III	6	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	3	94	56
Description			
This section includes a description of the module, design in discrete domain: Shanno's sampling theorem, ideal sampling .Sample and Hold-Digital equivalents ,stability in the Z-plane,-Impulse and step invariant transformations Methods of discretization - Effect of sampling- Direct discrete design – discrete root locus, digital compensator design. Design examples Discrete state variable design: Discrete pole placement- state and output feedback-estimated state feedback-discrete optimal control- dynamic programming-Design examples Optimal and Robust Control System Design: Review of optimal control, the linear quadratic regulator, the Kalman filter, robust control, H2 and H∞ optimal control, robust stability and robust performance, multivariable robust control.Liapunov Stability analysis, Liapunov Stability analysis of LTI systems, Model reference control systems, quadratic optimal control Non- linear systems: Common physical nonlinearities, the phase plane methods, Singular points, stability of nonlinear systems, Construction of phase trajectories. The describing function methods: Basic concepts, derivation of describing functions for common non linearity's, stability analysis by Describing function approach, Jump resonance, Lyapunov stability criterion			

Module41

Code	Course/Module Title	ECTS	Semester
EL425	Elective (Antenna and Wave propagation)	4	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	37
Description			
Antenna and Wave propagation is a captivating field in electrical engineering that explores the principles of antenna design and analysis, as well as the behavior of electromagnetic waves. This subject covers fundamental aspects such as radiation patterns, antenna gains, efficiency, impedance, and various types of antennas. It also delves into antenna systems, their configurations, and advanced parameters like directivity, beam width, polarization, and impedance matching. The study of wireless wave propagation involves understanding wave behavior in different mediums, including reflection, diffraction, refraction, and multipath propagation. Additionally, this subject covers wave propagation models, antenna measurements and testing techniques, and advanced antenna technologies like smart antennas and phased array antennas.			

Module42

Code	Course/Module Title	ECTS	Semester
EE416	Engineering Project	4	7
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	2	48	52
Description			
This section includes a description of the module, This is an independent study under the supervision of department members. Each student is expected to do research trying to explore and define a potential study area suitable for a senior design project. A specific engineering problem must then be identified from within the selected study area. Results from this study must be documented and submitted in the form of a design project proposal. Research Methodology : Overview of Research and its Methodologies Concepts of research, The need for research , Types of research , Steps in conducting research. Literature review: What is literature review?, Why the need for literature review?, How to carry out a literature review? Selecting and defining a research problem: Problem formulation – why the need for this? What are the criteria for selecting a problem? Identifying variables, Evaluating problems, Functions of a hypothesis. Conducting the research: Research activities, Preparations before conducting your research Examples of Research at the University: Differences among Postgraduate and Undergraduate Research, Research at the postgraduate level (PhD and M.Sc.), Research at the undergraduate level (B.Sc.), Preparations for an Undergraduate Final Year Project.			

Module43

Code	Course/Module Title	ECTS	Semester
EL421	Power System Analysis II	5	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	62
Description			
This section includes a description of the module, System Protection : Switchgear, circuit breakers, quantities required of protection, primary and back-up protection, current transformers, voltage transformers, relays, protection system, over-current protection, over-current and directional, distance protection, unit protection, differential relaying, generator protection, transformer protection, T.L. protection, motor protection. Power System Control: Introduction to power system control and its importance, modes of power system operation, major tasks of operation. SCADA system, control centers, controller tuning, communication sub system, remote terminal unit, data logging. Economic dispatch: Characteristics of power generation units, economic dispatch problems with and without consideration of losses, incremental fuel cost, penalty factor, economic power interchange. Voltage, power and frequency control. Evaluation of the effect of speed change on droop characteristics			

Module44

Code	Course/Module Title	ECTS	Semester
EL422	Special Machine	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	3	94	56
Description			
This section includes a description of the module, DC servo mechanism: Armature -controlled DC motors, field-controlled DC motors, motor generator transfer function. Two-Phase Servo Motors: Main requirements of servos, two phase servo motor transfer function, the IM as a servo motor, drug cup construction, introduction to tacho generators and induction tacho generators. Shaded Pole Motors: Construction, principle of operation, speed reversal and speed changing. Universal and Single Phase AC Series Motors Principles, torque and speed equations, small universal and large AC motors, speed changing, applications. Single-Phase Repulsion Motors: Repulsion principles and repulsion motors, repulsion start IM, repulsion IM. Stepper Motors: Permanent magnet stepper motors, variable reluctance stepper motors, torque-speed characteristics, step angle and speed. Reluctance motors: Single and three phase reluctance motors, construction and principle of operation. Linear Induction Motor: Construction, principle of operation, applications			

Module45

Code	Course/Module Title	ECTS	Semester
EL423	Digital Communication	6	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	3	94	56
Description			
This section includes a description of the module, Spread Spectrum Modulation: model of spread spectrum system, generation of pseudo-noise (PN) sequences, direct sequence spread spectrum (DS-SS) signals, frequency hopped spread spectrum (FH-SS) signals, synchronization in spread spectrum systems, comparison of spread spectrum methods, application of spread spectrum modulation. Digital Multiplexers: Introduction to multiplexing, A PAM/TDM System, Introduction to Digital Multiplexing, Classification of Digital Multiplexing, Multiplexing Hierarchy for Digital Communications, North American hierarchy, T Lines, A PCM-TDM System (T1 Carrier System) , E Lines. Multiuser Detection and OFDM Communications. Introduction to multiuser Detection (MUD), OFDM (Multicarrier) Communication: Basic principles, Channel noise in OFDM system, Zero-Padded OFDM System, Cyclic prefix redundancy in OFDM system, OFDM equalization			

Module46

Code	Course/Module Title	ECTS	Semester
EL424	Advanced Electronics	5	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	62
Description			
This section includes a description of the module, Monostable Multivibrator, Astable Multivibrator, Bistable Multivibrator, Applications of Multivibrator, IC 555 Timer, Basic Operational Characteristics of logic circuits, CMOS circuits, TTL (Bipolar) circuits, Emitter-Coupled Logic (ECL) circuits, PMOS and NMOS circuits, E^2CMOS circuits, Analog-to-Digital converter, Methods of Analog-to-Digital conversion, Digital-to-Analog converter Methods of Digital-to-Analog conversion, Signal conversion and processing Random Access Memory (RAM), Read Only Memory (ROM), Programmable ROMs (PROM, EPROM, EEPROM), Flash Memory, Memory Expansion, Microcomputer Organization, Microprocessor Organization, Memory Organization, Memory Addressing Modes, Microcontrollers and Embedded systems, Programmable Logic Controller (PLC), Arduino Microcontroller, Simple Programmable Logic Devices (SPLD), Complex Programmable Logic Devices (CPLD), Field-Programmable Gate Array (FPGA)			

Module47

Code	Course/Module Title	ECTS	Semester
EL425	Elective (Renewable Energy)	4	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
3	1	63	37
Description			
This section includes a description of the module, Introduction to Renewable Energy Systems,Solar Photovoltaic Systems, Wind Energy Conversion Systems (WECS),Hydroelectric Power Systems, Geothermal Energy Systems, Biomass Energy Systems, Power electronics for renewable energy systems, Maximum power point, Integration and Grid Connection, Energy Storage Technologies, Economic and Environmental Analysis, Sustainable Development and Future Trends.			

Module48

Code	Course/Module Title	ECTS	Semester
EE426	Engineering Project	4	8
Class (hr/w)	**Lect/Lab./Prac./Tutor**	**SSWL (hr/sem)**	**USWL (hr/w)**
1	2	48	52
Description			
This section includes a description of the module, This is the continuation of engineering project I. Engineering Ethics: Introduction: Background Ideas , Why Study Engineering Ethics?, Engineering Is Managing the Unknown , Personal vs. Professional Ethics , The Origins of Ethical Thought , Ethics and the Law , Ethics Problems Are Like Design Problems , Case Studies ,Summary. Professionalism and Codes of Ethics: Introduction, Is Engineering a Profession? Codes of Ethics. Understanding Ethical Problems: Introduction , A Brief History of Ethical Thought , Ethical Theories non-Western Ethical Thinking. Ethical Problem-Solving Techniques: Introduction, Analysis of Issues in Ethical Problems , Line Drawing , Flow Charting , Conflict Problems, An Application of Problem-Solving Methods: Bribery/Acceptance of Gifts. Risk, Safety, and Accidents: Introduction, Safety and Risk, Accidents. The Rights and Responsibilities of Engineers: Introduction, Professional Responsibilities, Professional Rights, Whistle-Blowing. Ethical Issues in Engineering Practice: Introduction, Environmental Ethics, Computer Ethics, Ethics and Research. Doing the Right Thing: See how ethical problems can be avoided; learn how engineers can cooperate with each other and with clients and government agencies to be sure that the ethically correct choice is made. Analysis current ethics problem like what happen in Volkswagen's company. Selective Case Study.			

Contact

Program Manager:

Ahmed Raisan Hussein | Ph.D. in Biology | Assistant Prof.

Email: alhusseinahmed70@uomisan.edu.iq

Mobile no.:07708861738

Program Coordinator:

Hussein Tuama Hazim | MS.C. in Electrical Engineering/ Communication | Lecture.

Email: Hussein.tuama @uomisan.edu.iq

Mobile no.: '07735717775

MODULE DESCRIPTION FORM

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="2">Fundamentals of Electrical Engineering I</td><td colspan="3">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="2">C</td><td colspan="3" rowspan="4">√Theory
√ Lecture
√Lab
√Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="2">EL111</td></tr>
<tr><td>ECTS Credits</td><td colspan="2">8</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="2">200</td></tr>
<tr><td colspan="2">Module Level</td><td>1</td><td colspan="2">Semester of Delivery</td><td>ONE</td></tr>
<tr><td colspan="2">Administering Department</td><td>Electrical Dep.</td><td>College</td><td colspan="2">Engineering</td></tr>
<tr><td>Module Leader</td><td colspan="2">Dr. Jabbar R. Rashed</td><td>e-mail</td><td colspan="2">dr.jabar72@uomisan.edu.iq</td></tr>
<tr><td colspan="2">Module Leader’s Acad. Title</td><td>Assist. Professor</td><td colspan="2">Module Leader’s Qualification</td><td>Ph.D.</td></tr>
<tr><td>Module Tutor</td><td colspan="2">Name (if available)</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Name</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Scientific Committee Approval Date</td><td>01/06/2023</td><td colspan="2">Version Number</td><td>1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. To develop problem solving skills and understanding of circuit theory through the application of techniques. 2. To understand voltage, current and power from a given circuit. 3. To deals with the basic concept of electrical circuit. 4. To understand Kirchhoff's current and voltage Laws problems. 5. To perform Mesh and Nodal analysis. 6. To apply Thevenin's , Norton's , superposition, maximum power transfer theorem to find different electric quantities. 7. To understand the magnetic circuit with some important application.
Module Learning Outcomes	1. Describe electrical quantities such that: charge, current, voltage, power, energy, with List the various terms associated with electrical circuits. 2. Define Ohm's law and identify resistance of material and effect of temperature on the resistance. 3. Explain the two Kirchhoff's laws used in series and parallel circuit analysis. 4. Apply analysis method to series –parallel circuit. 5. Explain the mesh analysis in DC circuit with and without current source. 6. Explain the nodal analysis in DC circuit with and without voltage source. 7. Introduce superposition theorem to find the solution to network with two or more sources. . 8. Understanding Thevenin theorem to provide an equivalence circuit for any selected terminal of the circuit. . 9. Understanding Norton theorem to provide an equivalence circuit for any selected terminal of the circuit. 10. Use Thevenin theorem and Norton theorem to find maximum power transfer to the load. 11. Explain substation , reciprocal and Millman theorem. 12. Describe the magnetic circuit and explain the important laws in the magnetization with some application.
Indicative Contents	Indicative content includes the following. **Part A - Circuits Analysis** DC circuits – Current and voltage definitions, Passive sign convention and circuit elements, Combining resistive elements in series and parallel. Kirchhoff's laws and Ohm's law. analysis of a circuit, Network reduction, Introduction to mesh and nodal analysis. [40 hrs] **Part B - Circuits Theorems** Superposition theorem, Thevenin theorem, Norton theorem, maximum power transfer theorem, millman theorem, substitution theorem, and reciprocal theorem. [20 hrs] **Part C – Magnetic Circuits** Magnetic fields, flux density, permeability, reluctance, ohms law for magnetic circuits, magnetizing force, hysteresis, Ampere circuital law, the flux and determine NI in the series and parallel magnetic circuits and air gaps. [15 hrs]

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 types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	109	**Structured SWL (h/w)**	7
Unstructured SWL (h/sem)	91	**Unstructured SWL (h/w)**	6
Total SWL (h/sem)	**200**		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Basic concepts: system of units, charge, current, voltage, power, energy, circuit elements
Week 2	Resistance of conductors and temperature effects, temperature coefficient of resistance
Week 3	Basic laws: Ohm law, series resistance , Kirchhoff's voltage law and voltage divider.
Week 4	Basic laws:, parallel resistance Kirchhoff's current law and current divider.
Week 5	Basic laws, series – parallel network, ladder network, Star-delta connection..
Week 6	Methods of analysis: Mesh Analysis
Week 7	Methods of analysis: Mesh Analysis , Nodal Analysis
Week 8	Methods of analysis: Nodal Analysis
Week 9	Circuit theorems: superposition theorem, source transformation
Week 10	Circuit theorems: Thevenin 's theorem
Week 11	Circuit theorem : Norton's theorem
Week 12	Circuit theorem : Maximum power transfer theorem , substitution theorem, reciprocal theorem and Millman's theorem
Week 13	Magnetic circuits : Magnetic fields, flux density, permeability, reluctance,
Week 14	Magnetic circuits: ohms law for magnetic circuits, magnetizing force, hysteresis, Ampere circuital law.
Week 15	Magnetics circuits : the flux and determine NI in the series and parallel magnetic circuits and air gaps
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Introduction: types of resistance and how to read its values, measurement instrument (Ammeter, voltmeter, ohmmeter) and how to connect them in the electric circuit
Week 2	Series , parallel, series – parallel connection
Week 3	Kirchhoff voltage law & Kirchhoff current low
Week 4	Superposition theorem
Week 5	Thevemin's Theorem
Week 6	Norton's Theorem
Week 7	Maximum Power Transfer

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Charles k. Alexander, and Matthew N.O. Sadiku, "Fundamentals of Electric Circuits"	yes
Recommended Texts	Boylestad, "Introductory Circuit Analysis"	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 FORM

Module Information				
Module Title	Mathematics I		**Module Delivery**	
Module Type	**B**		☒Theory ☐Lecture ☐Lab ☒Tutorial ☐Practical ☐Seminar	
Module Code	EE112			
ECTS Credits	6			
SWL (hr/sem)	150			
Module Level	1		**Semester of Delivery**	One
Administering Department	Electrical Eng. Dep.		**College**	Engineering
Module Leader	Dr. Sinan Imad Sabri		**e-mail**	sisabri@uomisan.edu.iq
Module Leader's Acad. Title	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	01/06/2023		**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	Mathematics I aims to provide a comprehensive introduction to the mathematical concepts and techniques that are fundamental to study electrical engineering. During this course, students will develop a solid mathematical foundation that will support their understanding of advanced electrical engineering topics in subsequent semesters. The main module objectives are: 1. Introduce students to the basic mathematical concepts and notation. 2. Develop proficiency in algebraic manipulations and solving equations. 3. Introduce students to understand the concepts of sets, intervals and inequalities. 4. Provide an understanding of analytical geometry. 5. Provide an understanding of trigonometric functions and their applications. 6. Familiarize students with basic concepts of differentiation and the laws of differentiation on various mathematical functions. 7. Familiarize students with basic concepts in linear algebra.
Module Learning Outcomes	Students will be able to: 1. Understand the basic concepts related to this course. 2. Learn the concept of mathematical functions and related mathematical operations. 3. Understand how to represent mathematical functions and equations by drawing. 4. Understand trigonometric functions and their applications. 5. Learn the concept of differentiation and the laws of differentiation on various mathematical functions. 6. Understand how to apply differentiation to various engineering applications in general and applications related to Electrical Engineering in particular. 7. Understand some of the mathematical topics that needed to be understood to enter other courses in the Department of Electrical Engineering
Indicative Contents	Introduction to calculus: ● Equations and solution methods. ● Elements and Sets. ● Real Numbers and The Real Line. ● Interval, Union and Intersections of intervals. ● Inequalities. ● Analytical Geometry, Distance between Points and Midpoint Formula. ● Slope and Equation of Line. ● Functions (Sums, Difference, Product and Quotients of Functions). ● Domain and Range (Rf) of functions. ● Composition of Functions:

	• Absolute Value Function. • Graph of Functions (Graph of Curves). • Shifting, Shrinking and Stretching of functions. • Trigonometric Functions Derivatives • Definition. • Derivatives by the Limits. • Laws of Derivatives. • Second and Higher Order Derivative. • Implicit Differentiation. • The quotient rule for Derivative. • The Chain Rule. • Derivative of Parametric Equations. • Derivative of Trigonometric Functions. • Applications of Derivatives. Matrices • Introduction to Matrices: Definition and notation of matrices, matrix elements, size or dimensions of a matrix, special types of matrices (square, rectangular, row vector, column vector), equality of matrices. • Matrix Operations: Addition and subtraction of matrices, scalar multiplication, matrix multiplication. • Matrix determinant. • Matrix Inverses. • Matrix transpose. • Systems of Linear Equations. • Cramer’s rule. Limits and Continuity • Introduction. • Definition. • Properties of the Limits. • Right-hand limits and left-hand limits. • Limit Involving Infinity. • Continuous Function. • Algebraic properties of continuous functions.

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 in solving problems. This will be achieved through classes, interactive tutorials, homeworks and quizzes.

Student Workload (SWL)			
Structured SWL (h/sem)	78	**Structured SWL (h/w)**	5.2
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**	4	20% (10)	3, 6, 9 and 13	LO #2, #5, #8, and #12
	Assignments	4	20% (10)	3, 5, 9 and 12	LO #1, #2, #3, #4, #6, #7, #8, #10, and #11
	Projects / Lab.		10% (10)		
	Report		10% (10)		
Summative assessment	**Midterm Exam**	2 hr	10% (10)	10	LO #1 - #8
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to calculus, Equations and solution methods, Elements and Sets, Real Numbers and The Real Line, Interval, Union and Intersections of Intervals, and Inequalities.
Week 2	Analytical Geometry: Distance between points, Slope and equation of Line, Point Slope Equation, The Distance from Point to a Line, and Angles between two Lines.
Week 3	Assignment + Quiz + Functions : Definition, Domain and Range of Functions, Absolute Value Function, The Greatest Integer Function, and Composition of Functions.
Week 4	Graph of Functions: Symmetry Test for Graphs, Shifting, Shrinking and Stretching.
Week 5	Assignment + Trigonometric Functions: Definition and Identities of Trigonometric Functions, Graph of Trigonometric Functions.
Week 6	Quiz + Derivatives: Definition, Derivatives by the Limits, Laws of Derivatives, and Second and Higher Order Derivative
Week 7	Implicit Differentiation and the Quotient rule for Derivatives.
Week 8	The Chain Rule, Derivative of Parametric Equations, and Derivative of Trigonometric Functions.
Week 9	Assignment + Quiz + Applications of Derivatives, Analysis of Functions: Increase and Decrease, Concavity and Inflection Points, Horizontal and Vertical Asymptotes, and Oblique Asymptotes
Week 10	Mid Term + Matrices: Introduction to Matrices: Definition and notation of matrices, matrix elements, dimensions of a matrix, special types of matrices (square, rectangular, row vector, column vector)
Week 11	Matrices: equality of matrices, Matrix Operations: Addition and subtraction of matrices, scalar multiplication, matrix multiplication, Matrix determinant, Matrix Inverses, Matrix transpose.
Week 12	Assignment + Matrices: Systems of Linear Equations and Cramer’s rule.
Week 13	Quiz + Limits and Continuity: Introduction, Definition, and Properties of the Limits.
Week 14	Right-hand limits and left-hand limits, Limit Involving Infinity, Continuous Function, and Algebraic properties of continuous functions.
Week 15	**Review and solve related problems.**
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	GEORGE B. THOMAS, JR. “ Calculus ”, 14th edition, Cenveo® Publisher Services, 2018.	
Recommended Texts	Anthony Croft, Robert Davison, Martin Hargreaves, and James Flint “Engineering Mathematics, A Foundation for Electronic, Electrical ,Communications and Systems, Engineers”, Pearson Education, 2017.	
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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Basic physics</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">B</td><td colspan="2" rowspan="4">☒Theory
☐Lecture
☐Lab
☐Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">EE113</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">125</td></tr>
<tr><td>Module Level</td><td>1</td><td colspan="2">Semester of Delivery</td><td colspan="2">ONE</td></tr>
<tr><td>Administering Department</td><td>Electrical Dep.</td><td>College</td><td colspan="3">Engineering</td></tr>
<tr><td>Module Leader</td><td>Dr.baqer obaid alnashy</td><td>e-mail</td><td colspan="3">baqernano@uomisan.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Assistant Professor</td><td colspan="2">Module Leader’s Qualification</td><td colspan="2">Ph.D.</td></tr>
<tr><td>Module Tutor</td><td></td><td>e-mail</td><td colspan="3"></td></tr>
<tr><td>Peer Reviewer Name</td><td>Name</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Scientific Committee Approval Date</td><td>11/06/2023</td><td colspan="2">Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. To introduce the fundamental concepts of physics which provide a foundation for further study of materials, structures, mechanics and electronics at a level necessary to commence an engineering degree programme. 2. To consolidate a common knowledge base and begin the development of a learning methodology appropriate to an engineering degree programme. 3. On successfully completing the module you will be able to... 4. Demonstrate understanding of the fundamentals of physics 5. Apply basic concepts in the analysis of mechanical, electrical and thermal problems
Module Learning Outcomes	Syllabus plan 1. Introduction – physical parameters; dimensions and units; scalar and vector quantities; measurements; conservation of energy 2. Statics – (including forces and moments) 3. Structure of matter 4. Thermal propertiesand heat transport 5. Electrical properties
Indicative Contents	Indicative content includes the following. <u>Part A - Circuit Theory</u> Electrical Circuits: AC Circuits: Kirchhoffs laws for AC circuits, Complex Reactance and Impedance, Series LCR Circuit: (1) Resonance (2) Power Dissipation (3) Quality Factor, (4) Band Width, Parallel LCR Circuit.. [15 hrs] Semiconductor Diodes: P and N type semiconductors, energy level diagram, conductivity and Mobility, Concept of Drift velocity, PN junction fabrication (simple idea), Barrier formation in PN Junction Diode, Static and Dynamic Resistance, Current flow mechanism in Forward and Reverse Biased Diode, Drift velocity, derivation for Barrier Potential, Barrier Width and current Step Junction. Two terminal device and their applications: (1) Rectifier Diode: Half- [15 hrs] AC Circuits II - Phasor diagrams, definition of complex impedance, AC circuit analysis with complex numbers. [10 hrs] waveRectifiers.center-tappedandbridgetypeFull-waveRectifiers,Calculation of Ripple Factor and Rectification Efficiency,L and C Filters (2) Zener Diode and Voltage Regulation, Principle and structure of LEDS, (2) Photo diode(3) SolarCell.. [15 hrs]

	Revision problem classes [6 hrs] Part B - Analogue Electronics Fundamentals Resistive networks, voltage and current sources, Thevenin and Norton equivalent circuits, current and voltage division, input resistance, output resistance, coupling and decoupling capacitors, maximum power transfer, RMS and power dissipation, current limiting and over voltage protection. [15 hrs] Components and active devices – Components vs elements and circuit modeling, real and ideal elements. Introduction to sensors and actuators, self-generating vs modulating type sensors, simple circuit interfacing. [7 hrs] Diodes and Diode circuits – Diode characteristics and equations, ideal vs real. Signal conditioning, clamping and clipping, rectification and peak detection, photodiodes, LEDs, Zener diodes, voltage stabilization, voltage reference, power supplies. [15 hrs]

Learning and Teaching Strategies	
Strategies	يتم كتابة ستراتيجيات التعلم حسب المثال Type something like: 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.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	62	**Unstructured SWL (h/w)**	4.2
Total SWL (h/sem)	**125**		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Semiconductor introduction
Week 2	Energy band
Week 3	SI and Ge properties'
Week 4	Crystal structure of SI and Ge
Week 5	Mobility in Semiconductor
Week 6	Doping in Semiconductor
Week 7	Types of Semiconductor
Week 8	Drift and diffusions' current in semiconductor
Week 9	P-N junction characteristics
Week 10	diode
Week 11	Load line analysis for diode
Week 12	Diode models
Week 13	Type of diode
Week 14	Series and parallel diode configuration
Week 15	Gates of diode
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. ElectronicdevicesandcircuitsR.L.Boylstad(PearsonIndia) 2. Electronic Principles- A.P.Malvino (Tata McGrawHill)	
Recommended Texts	3. Principles of Electronics- V. K. Mehta and Rohit Mehta (S. Chand Publication)	
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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Computer Programming I</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">Core</td><td colspan="2" rowspan="4">☒Theory
☐Lecture
☒Lab
☒Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">UM114</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">125</td></tr>
<tr><td>Module Level</td><td colspan="2">1</td><td colspan="2">Semester of Delivery</td><td>One</td></tr>
<tr><td>Administering Department</td><td colspan="2">Electrical Dep.</td><td>College</td><td colspan="2">Engineering</td></tr>
<tr><td>Module Leader</td><td colspan="2">Dr. Haider Khalaf Allamy</td><td>e-mail</td><td colspan="2">Haider.allamy@uomisan.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td colspan="2">Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td>Ph.D.</td></tr>
<tr><td>Module Tutor</td><td colspan="2"></td><td>e-mail</td><td colspan="2"></td></tr>
<tr><td>Peer Reviewer Name</td><td colspan="2"></td><td>e-mail</td><td colspan="2"></td></tr>
<tr><td>Scientific Committee Approval Date</td><td colspan="2">01/06/2023</td><td>Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

<table>
<tr><th colspan="2">Module Aims, Learning Outcomes and Indicative Contents</th></tr>
<tr><td>Module Objectives</td><td>1. Thorough treatment of problem solving skills independent of any given language
2. Procedural/algorithmic program development. We do not believe that a long, thin course such as this can additionally support object-oriented concepts, and our commitment is to solid foundational learning. We expect the Level 2 curriculum to introduce object-oriented programming principles.
3. Awareness of the role of programming within the larger software engineering context, along with more general attitudes and study skills appropriate for Computing Science.
4. To acknowledge the complexity of this subject, progression requirements into Level 2 have been set a grade higher than for a standard pass. In this way, a solid performance is rewarded, even if we do not view the candidate as having the necessary skills for progression.</td></tr>
<tr><td>Module Learning Outcomes</td><td>Students will learn:
1. The fundamentals, the essential ideas, and the concepts for success in any programming language.
2. How to write a computer program and learn how to get the computer to understand it.
3. Explain pseudocode and its role in programming.
4. Explain the basic computer data structures such as arrays, lists, stacks, and queues.
5. All about the syntax - or rules of programming languages.
6. Explore how to make real-world programming easier, from libraries to frames, to SDKs and APIs.</td></tr>
<tr><td>Indicative Contents</td><td>Introduction, The Rules of Programming Languages, Working with Data, Creating and Naming Variables.
Using Variables and Operators, Choosing and Using Data Types, Applying Data Types, Creating Constants, Exploring Language Differences.
Managing Program Flow, Making Choices and Conditions, Creating Complex Conditions, Creating Loops.
Creating Functions, Returning Values and Using Parameters, Using Recursion.
Creating and Using Composite Data Types.
Arrays and Collections, Introducing Object-oriented Programming, Making Things Modular.</td></tr>
</table>

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 types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	64	**Structured SWL (h/w)**	4.2
Unstructured SWL (h/sem)	61	**Unstructured SWL (h/w)**	4
Total SWL (h/sem)	**125**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #7, #6
	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, #7 and #8
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	Introduction, The Rules of Programming Languages.
Week 2	Working with Data, Creating and Naming Variables
Week 3	Using Variables and Operators
Week 4	Choosing and Using Data Types, Applying Data Types
Week 5	Creating Constants, Exploring Language Differences
Week 6	Managing Program Flow
Week 7	Mid-term + Making Choices and Conditions
Week 8	**Quiz 1**

Week 9	Creating Complex Conditions and , Creating Loops
Week 10	Creating Functions, Returning Values and Using Parameters
Week 11	Using Recursion, Creating and Using Composite Data Types
Week 12	Arrays and Collections
Week 13	Introducing Object-oriented Programming
Week 14	**Quiz 2**
Week 15	Making Things Modular
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)

	Material Covered
Week 1	C++ Examples
Week 2	C++ Examples
Week 3	C# Examples
Week 4	Java Examples
Week 5	JavaScript Examples
Week 6	Python Examples
Week 7	Python Examples

Learning and Teaching Resources

	Text	**Available in the Library?**
Required Texts	Braunschweig, D. and Busbee, K. L. (2018). Programming Fundamentals – A Modular Structured Approach, 2nd Edition.	yes
Recommended Texts		
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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Engineering Drawing</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">B</td><td colspan="2" rowspan="4">☒ Theory
☐ Lecture
☒ Lab
☐ Tutorial
☐ Practical
☐ Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">EE115</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">4</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">100</td></tr>
<tr><td colspan="2">Module Level</td><td>1</td><td colspan="2">Semester of Delivery</td><td>One</td></tr>
<tr><td colspan="2">Administering Department</td><td>Electrical Dep.</td><td>College</td><td colspan="2">Engineering</td></tr>
<tr><td>Module Leader</td><td colspan="2">Haider Abdulkareem Raheem</td><td>e-mail</td><td colspan="2">eng.haider992@gmail.com</td></tr>
<tr><td colspan="2">Module Leader’s Acad. Title</td><td>Assist lecturer</td><td colspan="2">Module Leader’s Qualification</td><td>M.Sc</td></tr>
<tr><td>Module Tutor</td><td colspan="2">Haider Abdul kareem Raheem</td><td>e-mail</td><td colspan="2">eng.haider992@gmail.com</td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Name</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Scientific Committee Approval Date</td><td>01/06/2023</td><td>Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	8. Acquaintance the students with the fundamentals of drawing. 9. Introduce the basic and principles of technical drawings. 10. Enhance communication of engineering drawings and product design. 11. Develop students' inspiration skills of the geometric objects. 12. Develop a knowledge of both manual and computer generated engineering drawing. 13. Create, edit and print a variety of technical drawings using a CAD system.
Module Learning Outcomes	13. Understand and read the engineering drawing clearly. 14. communicate effectively in a modern technical environment. 15. Enhances Imagination to the geometric shapes. 16. construct and present quality engineering drawings in a well drafted manner. 17. present correct lettering, figures and dimensions to a defined style and standard. 18. produce detailed Electrical Engineering drawings using AutoCAD
Indicative Contents	**Part A - Sketching** (a) Paper size, Lettering & title blocks (b) Engineering operations. (c) Graphic geometry. (d)Orthographic projection (e) Isometric and oblique projection (f) Multi view ortho graphic projection in first and third angle projection. [20 hours] **Part B - Computer Aided Drafting** (a) Introduction to basic CAD concepts using AutoCAD. (b) Basic file management techniques. (c) Use and identify key components of the software relating to the 2D drawing environment. (d) Use the AutoCAD software co-ordinate system to aid accurate drawing. (e) Set up the drawing environment with the correct units in order to start producing drawings. (f) Use absolute/relative/polar X, Y co-ordinate system to produce basic measured objects through keyboard entry. (g) Use AutoCAD function keys. (h) Use hatch, text and simple dimensioning routines. (i) Basic editing and drawing commands. (j) Scale/load linetypes (k) Use a layering system and different line type styles and assign lineweights. (l) Create/edit basic block (m) Create isometric drawings in 2D AutoCAD (n) Use of polar and circle array (o) Introduction to dynamic blocks (p) Enhancing CAD drawings with text, symbols and blocks. (q) Transferring data using the Design Centre. (r) Create basic dimension styles to suit viewport scales. [20 hours] **Part C - Practical CAD drawing exercises** (a) Foundation detail (b) Auto CAD 2D practice drawing (c) Auto CAD 3D geometric layout and sections (d) AutoCAD Single Line Diagram Drawing (e) Electrical panel CAD drawing. [5 hours]

Learning and Teaching Strategies	
Strategies	The student work will be assessed according to the module tasks. The excises in the drawing hall will be marked weekly. And the homework will be assessed next lecture. During both assessments the student will give the oral and written feedback in order to improve their skills. The final exam will be done at the end of the semester.

Student Workload (SWL)			
Structured SWL (h/sem)	48	**Structured SWL (h/w)**	3.2
Unstructured SWL (h/sem)	52	**Unstructured SWL (h/w)**	3.4
Total SWL (h/sem)	**100**		

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	10	10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	20% (20)	Continuous	All
	Report	0	0% (0)	---	----
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	Introduction, Graphic Instruments and Their Use, Lettering
Week 2	Engineering operations.
Week 3	Graphic Geometry
Week 4	Multi View Ortho Graphic Projection in First and Third Angle Projection
Week 5	Multi View Ortho Graphic Projection in First and Third Angle Projection
Week 6	Multi View Ortho Graphic Projection in First and Third Angle Projection
Week 7	**Mid- term** + Dimensions
Week 8	Third View
Week 9	Isometric Drawing and Sketching
Week 10	Isometric Drawing and Sketching
Week 11	Isometric Drawing and Sketching
Week 12	Oblique Drawing
Week 13	Oblique Drawing
Week 14	Section of Isometric Drawing Sectional View
Week 15	Section of Isometric Drawing Sectional View
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	The use of CAD in engineering drawing. Description of menu Bar and toolbars. Drawing Ellipse, Rectangle.
Week 2	Drawing line, poly line, Ray, Circle, point, Arc, etc.
Week 3	CAD Electrical, Mechanical/ Special features.
Week 4	The use of various layers.
Week 5	Drawing electrical symbols on simple architectural plans.
Week 6	3-D Drawing, render.
Week 7	Orthogonal projections and sectional views.

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Abdul-Rasul AL Khafaf , “Engineering Drawing” ,Baghdad, 1990	Yes
Recommended Texts	K. Venkata Reddy, “Textbook of Engineering Drawing” Second Edition, BS Publications, 2008	No, Only Websites Download Link Below
Websites	https://ia600107.us.archive.org/18/items/TextbookOfEngineeringDrawing_201802/Textbook%20of%20Engineering%20Drawing.pdf	

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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Academic English</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">S</td><td colspan="2" rowspan="4">☒Theory
☐Lecture
☐Lab
☐Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">UM116</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">2</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">50</td></tr>
<tr><td>Module Level</td><td>1</td><td>Semester of Delivery</td><td colspan="3">1</td></tr>
<tr><td>Administering Department</td><td>Electrical Dep.</td><td>College</td><td colspan="3">Engineering</td></tr>
<tr><td>Module Leader</td><td>Hayder Naser Al-Lami</td><td>e-mail</td><td colspan="3">hayderallami@uomisan.edu.iq</td></tr>
<tr><td>Module Leader's Acad. Title</td><td>Lecturer</td><td>Module Leader's Qualification</td><td colspan="3">M.Sc.</td></tr>
<tr><td>Module Tutor</td><td>Name (if available)</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Peer Reviewer Name</td><td>Name</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Scientific Committee Approval Date</td><td>01/06/2023</td><td>Version Number</td><td colspan="3">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	14. To enable the learner to communicate effectively and appropriately in real-life situations: 15. To use English effectively for study purposes across the curriculum; 16. To develop and integrate the use of the four language skills i.e. Reading, Listening, Speaking, and Writing;
Module Learning Outcomes	At the completion of the course, students will be able to: 1. Students will heighten their awareness of correct English grammar usage in all language skills. 2. Students will improve their speaking ability in English. 3. Students will review the grammatical forms of English and the use of these forms in specific communicative contexts, which include: class activities, homework assignments, reading of texts, and writing. 4. Students will improve their reading fluency skills. 5. Students will read university texts and expand their vocabulary. 6. Students will achieve these outcomes through the development of the following skills: focused reading skills work and exams; discussions of longer articles; and summary writing including the drafting process.
Indicative Contents	1. Introduction to the English language, and basic greetings. 2. Vocabulary building: Commonly academic used words, phrases, and expressions. 3. Grammar essentials: Nouns, verbs, adjectives, adverbs, tenses, and sentence structure. 4. Reading comprehension: Strategies for understanding and improving the reading text. 5. Writing skills: Sentence construction, punctuation paragraph development, and short essay writing. 6. Speaking skills: basic conversation practice. 7. Everyday communication: Practical English for social and functional situations.

Learning and Teaching Strategies	
Strategies	1. Encouraging students for learning by illustrating the importance of the English language in their studies and future career. 2. Motivate the spirit of competition between the students. 3. Use attractive visual examples to draw students' focus on the details. 4. Increasing the exercises at the points of weakness. 5. Maintain the ray of hope for the weak individuals through the stable opportunity to override failure.

Student Workload (SWL)			
Structured SWL (h/sem)	30	**Structured SWL (h/w)**	2
Unstructured SWL (h/sem)	17	**Unstructured SWL (h/w)**	1.3
Total SWL (h/sem)	**50**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	2 and 6	All
	Assignments	1	15% (15)	10	All
	Presentation	1	10% (10)	11	All
Summative assessment	**Midterm Exam**	2hr	15% (15)	7	All
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Basic English essentials
Week 2	Vocabulary enrichment and dictionary use
Week 3	English grammar
Week 4	English grammar
Week 5	English grammar
Week 6	Reading comprehension
Week 7	Mid-term exam
Week 8	Writing paragraph
Week 9	Writing paragraph
Week 10	Reading and writing.

Week 11	Basic conversation practice
Week 12	Basic conversation practice
Week 13	Reading practice
Week 14	Presentation
Week 15	**Presentation**
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	Oxford English for Electrical and Mechanical Engineering Student's Book	
Recommended Texts	basic English language skills Oxbridge academy Headway Student's Book	
Websites	https://www.ted.com/talks https://www.perfect-english-grammar.com/the-method.html https://www.merriam-webster.com/	

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

<table>
<tr><th colspan="5">Module Information</th></tr>
<tr><td>**Module Title**</td><td colspan="2">Fundamentals of Electrical Engineering II</td><td colspan="2">**Module Delivery**</td></tr>
<tr><td>**Module Type**</td><td colspan="2">C</td><td colspan="2" rowspan="4">√Theory
√ Lecture
√Lab
√Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>**Module Code**</td><td colspan="2">EL121</td></tr>
<tr><td>**ECTS Credits**</td><td colspan="2">8</td></tr>
<tr><td>**SWL (hr/sem)**</td><td colspan="2">200</td></tr>
<tr><td>**Module Level**</td><td>1</td><td>**Semester of Delivery**</td><td colspan="2">Two</td></tr>
<tr><td>**Administering Department**</td><td>Electrical Dep.</td><td>**College**</td><td colspan="2">Engineering</td></tr>
<tr><td>**Module Leader**</td><td>Dr. Jabbar R. Rashed</td><td>**e-mail**</td><td colspan="2">dr.jabar72@uomisan.edu.iq</td></tr>
<tr><td>**Module Leader's Acad. Title**</td><td>Assist. Professor</td><td>**Module Leader's Qualification**</td><td colspan="2">Ph.D.</td></tr>
<tr><td>**Module Tutor**</td><td>Name (if available)</td><td>**e-mail**</td><td colspan="2">E-mail</td></tr>
<tr><td>**Peer Reviewer Name**</td><td>Name</td><td>**e-mail**</td><td colspan="2">E-mail</td></tr>
<tr><td>**Scientific Committee Approval Date**</td><td>01/06/2023</td><td>**Version Number**</td><td colspan="2">1.0</td></tr>
</table>

Relation with other Modules			
Prerequisite module	Fundamentals of Electrical Engineering I	**Semester**	ONE
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	17. To develop problem solving skills and understanding of alternating waveform. 18. To understand meaning of voltage or current time- varying. 19. To deals with the sinusoidal current and phasor. 20. To introduce the concept of impedance and admittance of the circuit. 21. To understand Kirchhoff's current and voltage Laws problems. 22. To perform Mesh and Nodal analysis. 23. To apply Thevenin's , Norton's , superposition, maximum power transfer theorem to find different electric quantities. 24. To understand the generation of three phase voltage .
Module Learning Outcomes	19. Describe sinusoidal AC voltage characteristics and definitions . 20. Introduce general format of sinusoidal voltage and current. 21. Explain the phasor relation. 22. Understanding the terms: average value and effective (RMS) value. 23. Explain the response of R, L, and C elements to sinusoidal voltage and current. 24. Determine the average power and power factor 25. Solve the series , parallel and series – parallel AC circuit. 26. Explain the mesh analysis in AC circuit with and without current source. 27. Explain the nodal analysis in AC circuit with and without current source 28. Star-Delta and Delta-Star conversion 29. Introduce source conversion and superposition theorem to find the solution to network with two or more sources. . 30. Understanding Thevenin theorem to provide an equivalence circuit for any selected terminal of the circuit. . 31. Understanding Norton theorem to provide an equivalence circuit for any selected terminal of the circuit. 32. Use Thevenin theorem and Norton theorem to find maximum power transfer to the load. 33. Explain substation , reciprocal and Millman theorem. 34. Determine AC power, triangle power, and total P,Q, and S. 35. Understanding power factor correction 36. Introduce concept of series and parallel resonant circuit. 37. Introduce three phase circuits
Indicative Contents	Indicative content includes the following. **Part A - Circuit Analysis** Definition of AC sinusoidal waveforms, phase relation, response of elements to sinusoidal voltage or current, series circuit, parallel circuit, Kirchhoff laws, mesh analysis, nodal analysis[35 hrs] **Part B - Circuits Theorems** Superposition theorem, Thevenin theorem, Norton theorem, maximum power transfer theorem, millman theorem, substitution theorem, and reciprocal theorem. [20 hrs]

	<u>Part C – three phase system</u> Generation of three phase voltage, positive and negative sequence, connection balanced three phase voltage with balanced three phase load via three wire or four wire. Type of connection (star- delta, star-star, delta- delta, and delta-delta), power in balanced three phase system, unbalanced three phase system, power measurement in three phase system [20 hrs]

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 types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	109	**Structured SWL (h/w)**	7.2
Unstructured SWL (h/sem)	91	**Unstructured SWL (h/w)**	6
Total SWL (h/sem)	**200**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**		10% (10)	3	LO#1,#2,#3
				4	LO#4
				6	LO#7
				11	LO#13,#14
				14	LO#19
	Assignments		10% (10)	3,12	L0#4,#14
	Projects / Lab.		10% (10)	Continuous	All
	Report		10% (10)	13	ALL
Summative assessment	**Midterm Exam**		10% (10)	7	LO #1 - #8
	Final Exam		50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Basic concepts of AC circuit: definition, general format for sinusoidal voltage or current, phase relations,
Week 2	Average value , effective value, response of basic R, L, and C elements to a sinusoidal voltage or current.
Week 3	Series AC circuits , Kirchhoff's voltage law and voltage divider.
Week 4	Parallel resistance Kirchhoff's current law and current divider. Equivalent circuits
Week 5	Series – parallel network, ladder network, Star-delta connection.
Week 6	Methods of analysis: Mesh Analysis
Week 7	Mid-term Methods of analysis: Nodal Analysis ,
Week 8	Circuit theorems: superposition theorem, source transformation
Week 9	Circuit theorems: Thevenin 's theorem
Week 10	Circuit theorem : Norton's theorem
Week 11	Circuit theorem : Maximum power transfer theorem , substitution theorem, reciprocal theorem and Millman's theorem
Week 12	Three phase system
Week 13	Power in balanced three phase system
Week 14	unbalanced three phase system
Week 15	Three phase power measurement
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Introduction: oscilloscope instrument and use it to display of alternating waveform and measurement of frequency, voltage, and phase shift.
Week 2	Response of pure R, L, and C elements to sinusoidal voltage
Week 3	Frequency response of series R-C circuit
Week 4	Frequency response of parallel R-l circuit
Week 5	Phase measurement by Lissajous pattern

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Charles k. Alexander, and Matthew N.O. Sadiku, "Fundamentals of Electric Circuits"	yes
Recommended Texts	Boylestad, "Introductory Circuit Analysis"	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 FORM

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Mathematics II</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">B</td><td colspan="2" rowspan="4">☒Theory
☐Lecture
☐Lab
☒Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">EE122</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">6</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">150</td></tr>
<tr><td>Module Level</td><td>1</td><td colspan="2">Semester of Delivery</td><td colspan="2">Two</td></tr>
<tr><td>Administering Department</td><td>Electrical Eng. Dep.</td><td>College</td><td colspan="3">Engineering</td></tr>
<tr><td>Module Leader</td><td>Dr. Sinan Imad Sabri</td><td>e-mail</td><td colspan="3">sisabri@uomisan.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td colspan="2">Ph.D.</td></tr>
<tr><td>Module Tutor</td><td>Name (if available)</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Peer Reviewer Name</td><td>Name</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Scientific Committee Approval Date</td><td>01/06/2023</td><td colspan="2">Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>EE112</td><td>Semester</td><td>One</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	Mathematics II aims to introduce students to the concept of integration and its importance to electrical engineering. Students will learn various integration methods, applications of definite integrals, and numerical integration. In addition to that, transcendental functions, complex numbers and polar coordinates will be covered in Mathematics II. The module objectives can be concluded as follow: 1. Introduce students to understand the concept of integration and how to solve related problems. 2. Identify different integration techniques and use them correctly to find the integrals of different functions. 3. Understand the effective methods of using integrals in problems related to electrical engineering applications. 4. Understand how to deal with complex numbers and use it with all associated mathematical operations 5. Familiarize students with the concepts of polar coordinates.
Module Learning Outcomes	Students will be able to: 1. Understand the concept of integration and its importance in engineering applications. 2. Demonstrate proficiency in performing basic integration operations. 3. Apply integration techniques, including substitution, integration by parts, partial fractions, and trigonometric substitutions, to solve a variety of engineering problems. 4. Analyze and interpret the geometric and physical significance of definite integrals in the context of electrical engineering, such as computing areas and volumes. 5. Utilize numerical integration techniques, such as the trapezoidal rule and Simpson's rule, to approximate definite integrals in practical scenarios. 6. Perform arithmetic operations with complex numbers and find complex conjugates. 7. Convert equations between rectangular and polar forms.
Indicative Contents	Indefinite Integrals ● Rules for indefinite integrals ● Integration of trigonometric functions ● Solving Initial Value Problems with Indefinite Integrals ● Definite Integrals ● Rules for Definite Integrals Techniques of Integration ● Basic Integration Formulas (by Substitution) ● Integration by Parts ● Tabular integration

	- Trigonometric Integrals - Definite integrals of odd and even functions - Integration by Trigonometric Substitutions - Integrating Rational Functions by Partial Fractions - Integration by substitution - Numerical integration (The Trapezoidal Rule and Simpson Rule) Application of Integrals: - Area under a curve - Finding the area between two curves - Volume of solids of revolution - Length of curves Transcendental Functions: - Inverse functions - Logarithmic functions Complex Numbers: - Complex numbers and operations - Graphical representation of complex numbers - Polar form of a complex number Polar Coordinates: - Definition of polar coordinates - Polar equations and graphs - Polar and cartesian coordinates - Graphing polar coordinate equations

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 in solving problems. This will be achieved through classes, interactive tutorials, homeworks and quizzes.

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**	4	20% (10)	3, 5, 12 and 15	LO #1, #2, #3, #4, # 9, #10, #11, #12, #13, and #14
	Assignments	4	20% (10)	3, 5, 12 and 15	LO #1, #2, #3, #4, # 9, #10, #11, #12, #13, and #14
	Projects / Lab.		10% (10)		
	Report		10% (10)		
Summative assessment	**Midterm Exam**	2 hr	10% (10)	8	LO #1 - #7
	Final Exam	3 hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Integration: Indefinite Integrals, Rules for Indefinite Integrals, Integration of Trigonometric Functions.
Week 2	Solving Initial Value Problems with Indefinite Integrals, Definite Integrals, Rules for Definite Integrals.
Week 3	Assignment + Quiz + Techniques of Integration, Basic Integration Formulas by Substitution, and Integration by Parts.
Week 4	Tabular Integration, Trigonometric Integrals, and Definite Integrals of Odd and Even Functions.
Week 5	Assignment + Quiz + Integration by Trigonometric Substitutions.
Week 6	Integrating Rational Functions by Partial Fractions.
Week 7	Integration by Substitution and Integrating of theRroots.
Week 8	Mid Term + Numerical integration: Trapezoidal Rule and Simpson Rule.
Week 9	Application of Integrals: Area Under a Curve and Finding Area between two Curves.
Week 10	Volume of Solids of Revolution.
Week 11	Length of Plane curves and Area of Surface of Revolution.
Week 12	Assignment + Quiz + Transcendental Functions: Inverse Functions and Logarithmic Functions.

Week 13	Complex Numbers, Complex Numbers and Operations, Graphical Representation of Complex Numbers, and Polar Form of a Complex Number.
Week 14	Polar Coordinates: Definition of Polar Coordinates, Polar Equations and Graphs, Polar and Cartesian Coordinates, and Graphing Polar Coordinate Equations.
Week 15	Assignment + Quiz + **Review and solve related problems.**
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	GEORGE B. THOMAS, JR. " Calculus ", 14th edition, Cenveo® Publisher Services, 2018.	
Recommended Texts	Anthony Croft, Robert Davison, Martin Hargreaves, and James Flint "Engineering Mathematics, A Foundation for Electronic, Electrical ,Communications and Systems, Engineers", Pearson Education, 2017.	
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

Module Information				
Module Title	Chemistry		**Module Delivery**	
Module Type	B		☒Theory ☐Lecture ☐Lab ☐Tutorial ☐Practical ☐Seminar	
Module Code	EE123			
ECTS Credits	3			
SWL (hr/sem)	75			
Module Level	1		**Semester of Delivery**	Two
Administering Department	Electrical Dep.		**College**	Engineering
Module Leader			**e-mail**	
Module Leader's Acad. Title	Assistant Professor		**Module Leader's Qualification**	Ph.D.
Module Tutor			**e-mail**	
Peer Reviewer Name	Name		**e-mail**	E-mail
Scientific Committee Approval Date	1/06/2023		**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	To introduce and develop key concepts in physical chemistry, in particular those of importance in chemical engineering processes 6. To energy conservation in closed, open and reacting systems. 7. To Understand the phase behaviour of substances and how to use the phase rule. 8. Understand the concepts of chemical potential, ideal and non-ideal conditions, and activity coefficients. 9. Calculate changes in enthalpy, entropy, Gibbs' free energy, and equilibrium constants of chemical reactions. 10. To Understand the basic principles of electrochemistry. 11. To Understand the basic principles of the physical chemistry of interfaces.
Module Learning Outcomes	1- Understand conductance of electrolytes and their behavior 2-Describe strong and week ions and their conductance behavior 3-Calculate conductivity, resistance, and cell constant for electrolyte solutions 4-Understand principles of measuring conductivity using conductometric sensors. 5-Describe types of conductometric sensors and their applications 6-Use conductivity measurements to determine concentration of electrolyte solutions. 7-Define the degree of dissociation and calculate it for a given solution 8-Understand the effect of concentration, temperature, and pressure on dissociation of electrolyte solutions. 9- Define the transference number and relate it to mobility of ions in electrolyte solutions 10-Describe methods to measure transference number. 11- Understand concepts of oxidation and reduction and their relation to electron transfer 12- Identify oxidizing and reducing agents in chemical reactions 13-Apply the concept of oxidation and reduction to balance redox equations and predict spontaneous redox reactions.
Indicative Contents	Indicative content includes the following. <u>Part A - Eleectric conductance in Electrolytes</u> Electric conductance in electrolytes measures how well electrolytes conduct

	electricity. Factors affecting it include concentration, temperature and ionic mobility. It's measured in siemens (S) using a conductometer. Applications include determination of molar and equivalent conductance. [6 hrs] Measurements of Conductivity of Electrolytes: The measurement of conductivity of electrolytes involves the use of a conductometer to measure the flow of electric current through the solution. Conductivity is affected by factors such as concentration, temperature and the type and mobility of ions in the electrolyte. Conductivity measurements can be used to determine parameters such as molar conductance, equivalent conductance and ion concentration.: [6 hrs] The degree of dissociation of electrolytes in a solution is a measure of the extent to which they break down into ions. It can be determined experimentally by measuring the conductivity of a solution of known concentration and comparing it to the conductivity of a similar solution of a non-electrolyte. The degree of dissociation is affected by factors such as temperature, concentration, and the nature of the electrolyte. It is an important parameter in determining the properties and behavior of electrolyte solutions. [6hrs] Revision problem classes [3 hrs] <u>Part B - Transference number of Ions</u> The transference number of ions is a measure of the mobility of a particular ion in an electrolytic solution. It represents the fraction of the total electrical current carried by that ion. The transference number can be experimentally determined by measuring the current carried by a single type of ion in a solution of known concentration and comparing it to the total current carried by all ions in that solution. The transference number is dependent on factors such as the nature and concentration of the electrolyte, as well as the temperature and pressure. It is used in various fields, including electrochemistry and battery technology, to predict and control ion transport. [6 hrs] Oxidation and reduction reactions involve the transfer of electrons from one substance to another. Oxidation is the loss of electrons, while reduction is the gain of electrons. These reactions commonly involve the transfer of oxygen atoms or hydrogen atoms, hence the term "redox" (reduction-oxidation). Oxidation and reduction reactions are fundamental in many chemical and biological processes. Examples include combustion, photosynthesis, respiration, and corrosion. Oxidation and reduction reactions can be balanced using the half-reaction method, and can be detected using redox indicators and electrode potentials. [6 hrs]

Learning and Teaching Strategies	
Strategies	Electrochemistry is a branch of chemistry that deals with the relationship between electricity and chemical reactions. This field of study has important applications in a variety of areas including energy generation, corrosion prevention, and chemical synthesis. Electrochemistry is essential in the development of technologies such as batteries, fuel cells and solar cells that generate electrical energy from chemical reactions. Another important application of electrochemistry is in corrosion science, where it is used to study and prevent the degradation of metals and other materials due to electrochemical reactions.

Student Workload (SWL)			
Structured SWL (h/sem)	33	**Structured SWL (h/w)**	2.2
Unstructured SWL (h/sem)	42	**Unstructured SWL (h/w)**	2.8
Total SWL (h/sem)	**75**		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction in Electrochemistry, Additionally, electrochemistry plays a vital role in the synthesis of materials
Week 2	Overall, electrochemistry is a fascinating field of study that has a wide range of applications and continues to be an active area of research and development.
Week 3	Electric conductance in electrolytes measures how well electrolytes conduct electricity. Factors affecting it include concentration, temperature and ionic mobility.
Week 4	The measurement of conductivity of electrolytes involves the use of a conductometer to measure the flow of electric current through the solution.
Week 5	Conductivity measurements can be used to determine parameters such as molar conductance, equivalent conductance and ion concentration.
Week 6	degree of dissociation of electrolytes in a solution is a measure of the extent to which they break down into ions.
Week 7	can be determined experimentally by measuring the conductivity of a solution of known concentration and comparing it to the conductivity of a similar solution of a non-electrolyte.
Week 8	The degree of dissociation is affected by factors such as temperature, concentration, and the nature of the electrolyte.
Week 9	It is an important parameter in determining the properties and behavior of electrolyte solutions.
Week 10	transference number of ions is a measure of the mobility of a particular ion in an electrolytic solution., It represents the fraction of the total electrical current carried by that ion.
Week 11	The transference number can be experimentally determined by measuring the current carried by a single type of ion in a solution of known concentration and comparing it to the total current carried by all ions in that solution.
Week 12	The transference number is dependent on factors such as the nature and concentration of the electrolyte, as well as the temperature and pressure. It is used in various fields.
Week 13	Oxidation and reduction reactions involve the transfer of electrons from one substance to another.
Week 14	Oxidation is the loss of electrons, while reduction is the gain of electrons. These reactions commonly involve the transfer of oxygen atoms or hydrogen atoms, hence the term "redox" (reduction-oxidation).
Week 15	Oxidation and reduction reactions are fundamental in many chemical and biological processes. Examples include combustion, photosynthesis,
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-The degree of Dissociation of Electrolytes in Solution: P. Atkins and J. de Paula, "Physical Chemistry," 11th ed. Oxford University Press, (2017), Electronic Principles- A.P.Malvino (Tata McGrawHill)	online
Recommended Texts	2- Physical Chemistry by Peter Atkins and Julio De Paula, Chapter 11, Oxford University Press, 2017, 3- Inorganic Chemistry by Catherine E. Housecroft and Alan G. Sharpe,	online
Websites	https://chem.libretexts.org/Courses/Athabasca_University/Chemistry_350%3A_Organic_Chemistry_I/10%3A_Organohalides/10.08%3A_Oxidation_and_Reduction_in_Organic_Chemistry.	

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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Computer Programming II</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">C</td><td colspan="2" rowspan="4">☒Theory
☐Lecture
☐Lab
☐Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">EL124</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">125</td></tr>
<tr><td>Module Level</td><td>1</td><td colspan="2">Semester of Delivery</td><td colspan="2">TWO</td></tr>
<tr><td>Administering Department</td><td>Electrical Dep.</td><td>College</td><td colspan="3">Engineering</td></tr>
<tr><td>Module Leader</td><td>Assist.Lect. Ahmed Majed Althahabi</td><td>e-mail</td><td colspan="3">ahmedmajed@uomasan.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Assistant Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td colspan="2">Assist.Lect.</td></tr>
<tr><td>Module Tutor</td><td>Name (if available)</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Peer Reviewer Name</td><td>Name</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Scientific Committee Approval Date</td><td>/06/2023</td><td>Version Number</td><td colspan="3">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>EL114</td><td>Semester</td><td>1</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

<table>
<tr><th colspan="2">Module Aims, Learning Outcomes and Indicative Contents</th></tr>
<tr><td>Module Objectives</td><td>1. To Impart the Knowledge to the students with MATLAB software.
[This enhances programming knowledge in Research and Development].
2. To provide a working introduction to the Matlab technical computing environment. [Themes of data analysis, visualization, and programming].
3. To introduce students the use of a high-level programming language, Matlab. [Scientific problem solving with applications and examples from Engineering].
4. Ability to design scripts files in matlab with interactive Input and Output, utilizing arithmetic expression repetitions, decision making capabilities, analysing vectors and matrices.
5. Gain practical skills on programming using MATLAB.
6. To develop industry-standard software techniques to model and solve specific engineering problems using currently available programme, MATLAB, and Simulink</td></tr>
<tr><td>Module Learning Outcomes</td><td>After successful completion of this module, students will be able to:
Undertake arithmetic on scalars, vectors and matrices.
Ability to design MATLAB scripts with interactive Input and Output.
Utilizing arithmetic expression repetitions, decision making statements, different operations on matrices.
Create 2D and 3D plots of mathematical functions and data.
Solve a number of various problems Graduate skills learning outcomes.
Write MATLAB functions and scripts to solve engineering problems in various fields.
Evaluate advanced modelling and analysis techniques for the solution of practical and complex design problems.</td></tr>
<tr><td>Indicative Contents</td><td>Indicative content includes the following.
Fundamentals of Programming: This section provides an introduction to the essential concepts, principles, and techniques of programming. Students gain an understanding of the significance of programming, the role of programming languages, and the basic elements of a program. They also learn problem solving techniques and the process of designing and implementing algorithms.
Variables and Expressions: This topic focuses on variables, including their 53 types and characteristics. Students learn how to declare variables, assign values to them, and manipulate them using expressions and operators.
Statements and Control Flow: Students understanding the fundamental components of a program's logic and flow through statements. They explore different types of statements and conditional constructs used to make decisions and control the execution of a program.
Functions and Modularization: This subject covers functions, including their definition and usage. Students learn about parameters, arguments, and how to create reusable code through function abstraction. They also explore the concept of return values and principles of function design.
Recursion and Iteration: This topic explores techniques for repetition and solving complex problems. Students learn about recursion, where a function calls itself, and iteration using loops. They discover various types of loops and control statements to ensure efficient program flow.</td></tr>
</table>

Learning and Teaching Strategies	
Strategies	Think-Pair-Share: Integrate think-pair-share activities where students individually think about a programming problem or concept, pair up with a classmate to discuss their ideas, and then share their thoughts with the larger class. This encourages critical thinking, collaboration, and active participation. **Case-Based Learning:** Present real-life case studies or scenarios that require students to analyze, design, and implement Python solutions. This promotes problem-solving skills, critical thinking, and the application of programming concepts to practical situations. **Code Review Sessions**: Conduct code review sessions where students present their code to the class, explaining their thought process and seeking feedback. This promotes critical thinking, analysis of code quality, and constructive feedback exchange. **Quizzes and Assessments**: Incorporate regular quizzes and assessments to assess students' understanding of Python concepts, syntax, and problem-solving skills.Use online platforms or interactive tools that provide immediate feedback to enhance engagement and promote self-assessment. **Group Projects**: Assign group projects that require students to collaborate on developing a Python application or solving a programming problem. This encourages teamwork, division of tasks, and coordination, while applying their programming skills. **Homework Assignments**: Assign regular programming exercises and projects as homework. Encourage students to actively apply the concepts learned in class to real-world scenarios. Provide constructive feedback on their submissions to promote improvement and reinforce learning.

Student Workload (SWL)			
Structured SWL (h/sem)	64	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	61	**Unstructured SWL (h/w)**	4
Total SWL (h/sem)	**125**		

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
	Oral Discussion	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	3 hrs.	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	MATLAB basics - The MATLAB environment - Basic computer programming
Week 2	MATLAB basics - Variables and constants, operators and simple calculations
Week 3	MATLAB basics - Formulas and functions - MATLAB toolboxes
Week 4	MATLAB Matrices and Vectors - Matrix and linear algebra review - Vectors and matrices in MATLAB
Week 5	MATLAB Matrices and Vectors - Matrix operations and functions in MATLAB
Week 6	MATLAB programming - Algorithms and structures - MATLAB scripts and functions (m-files)
Week 7	MATLAB programming - Simple sequential algorithms - Control structures (if…then, loops)
Week 8	Mid Term Exam.
Week 9	MATLAB programming - Nested Loops Breaks, Repetition Structures: Nested Loops and the Break Statement
Week 10	MATLAB programming - Reading and writing data, file handling - Personalized functions - Toolbox structure
Week 11	MATLAB graphic functions
Week 12	MATLAB Numerical simulations - Numerical methods and simulations
Week 13	Random number generation – Monte carlo methods
Week 14	Hands-on session Interactive hands-on-session where the whole class will develop one or more MATLAB scripts that solve an assigned problem
Week 15	Review and solving related problems.
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Experiment No. (1) Introduction to MATLAB, Starting and Quitting MATLAB , Desktop Tools, Basic Commands, Practical Exercises
Week 2	Experiment No. (2) Working with Matrices , Entering Matrix , Subscripts , Basic Matrix Functions , Practical Exercises
Week 3	Experiment No. (3) Expressions , Variable , Numbers , Arithmetic Operators , Functions , Practical Exercises
Week 4	Experiment No. (4) Relational and Logical Operations , Relational Operations , Logical Operation , Bitwise Operation , Logical Functions , Practical Exercises
Week 5	Experiment No. (5) Plotting Function , Creating a Plot Using Plot Function , Adding Plots to an Existing Graph , Multiple Plots in One Figure , Setting Axis Limits , Axis Labels and Titles , Input / Output of Variables (Numbers and Strings) , Practical Exercises
Week 6	Experiment No. (7) Flow Control (if , else , switch , for , while , nested loops)
Week 7	Experiment No. (8) MATLAB Simulink Basic , Starting Simulink , Basic Elements , Building a System , Gathering Blocks , Modifying the Blocks , Connecting the Blocks , Running Simulations

Learning and Teaching Resources		
	Text	Available in the Library?
Required Texts	1- MATLAB Handbook with Applications to Mathematics, Science, Engineering, and Finance Jose Miguel David Baez-Lopez, David Alfredo Baez Villegas 2- MATLAB Commands and Functions(Dr. Brian Vick) (Alfio Quarteroni • Fausto Saleri •Paola Gervasio) Scientific Computing with MATLAB and Octave 3- INTRODUCTION TO MATLAB FOR ENGINEERING STUDENTS David Houcque Northwestern University (version 1.2, August 2005)	yes
Recommended Texts		

Websites	http://www.eng-tips.com/threadminder.cfm?pid=575 http://www.matlabtutorials.com/mathforum/ http://www.mathworks.in/matlabcentral/ http://www.cfd-online.com/Forums/tags/matlab.html http://diydrones.com/forum/topic/listForTag?tag=Matlab

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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Mechanical Engineering and workshop</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">B</td><td colspan="2" rowspan="4">☒Theory
☐Lecture
☒ Lab
☐Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">EE125</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">125</td></tr>
<tr><td colspan="2">Module Level</td><td>1</td><td colspan="2">Semester of Delivery</td><td>Two</td></tr>
<tr><td colspan="2">Administering Department</td><td>Electrical Eng. Dep.</td><td>College</td><td colspan="2">Engineering</td></tr>
<tr><td>Module Leader</td><td colspan="2">Hayder Naser Al-Lami</td><td>e-mail</td><td colspan="2">hayderallami@uomisan.edu.iq</td></tr>
<tr><td colspan="2">Module Leader’s Acad. Title</td><td>Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td>M.Sc.</td></tr>
<tr><td>Module Tutor</td><td colspan="2">Name (if available)</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Name</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Scientific Committee Approval Date</td><td>01/06/2023</td><td>Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. To apply the principles of mechanics to practical engineering problems. 2. To identify an appropriate structural system for studying a given problem and isolate it from its environment. 3. To teach safety rules and regulations on-site in an industrial environment and proper use of working tools, instruments, and machines. 4. To introduce basic workshop practices, production, labor, and time requirements of workshop operations. 5. To develop a simple mathematical model for engineering problems and carry out static analysis. 6. To carry out kinematic and kinetic analyses for particles and systems of particles.
Module Learning Outcomes	This course is essential in all engineering branches providing the students with the general basics of engineering science. by completing this course, students will be able:- 1- To understand how the world, both natural and man-made, works. 2- To understand physical principles, such as forces, motion, and equilibrium which has a crucial importance for any engineer. 3- To have a good knowledge of safety rules on-site in an industrial environment and increase the knowledge about the use of working tools, instruments, and machines. 4- To present a general guide for solving problems. 5- To show how to analyze systems of force. 6- To introduce the concept of free body diagram and equilibrium equation. 7- To present specific applications of frictional force analysis. 8- To study and classify the Kinematics and kinetics of particles and rigid bodies. 9- To know the basic of thermodynamics. 10- To know the basic of strength of materials
Indicative Contents	1- Static: Force system, force components, moment of a force, equilibrium, free body diagram, centroids and centre of gravity, centroids of area 2- Dynamics: Kinetics and Kinematics of particle, rectilinear motion, curvilinear motion 3- Workshop Skills The students are introduced to training programs in four workshops: welding, turning, carpentry, and casting. 4- Strength of Materials: Hook’s law, tension and compression stress

Learning and Teaching Strategies	
Strategies	6. Encouraging students for learning by illustrating the importance of Mechanical engineering in their studies and future career. 7. Motivate the spirit of competition between the students. 8. Use attractive visual examples to draw students' focus on the details. 9. Increasing the exercises at the points of weakness. 10. Maintain the ray of hope for the weak individuals through the stable opportunity to override failure.

Student Workload (SWL)			
Structured SWL (h/sem)	94	**Structured SWL (h/w)**	6.2
Unstructured SWL (h/sem)	31	**Unstructured SWL (h/w)**	2
Total SWL (h/sem)	**125**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	15% (15)	2, 4 and 9	All
	Assignments	1	10% (10)	9	All
	Report	2	10% (10)	3 and 5	All
Summative assessment	**Midterm Exam**	2hr	15% (15)	7	All
	Final Exam	3hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to mechanics: Basic Concepts, Scalars and Vectors, Newton's Laws, SI units, Problem Solving in Statics.
Week 2	Force systems: two- (Rectangular Components, Moment, Couple, Resultants)
Week 3	Force systems: two- (Rectangular Components, Moment, Couple, Resultants)
Week 4	Equilibrium: Free-Body Diagram
Week 5	Equilibrium: Free-Body Diagram
Week 6	Centroids and centre of gravity
Week 7	Mid-term exam
Week 8	Centroids of area
Week 9	Kinematics of Particles and rigid body
Week 10	Kinematics of Particles and rigid body
Week 11	Kinetics of Particle and rigid body (Force and Acceleration)
Week 12	Kinetics of Particle and rigid body (Force and Acceleration)
Week 13	Kinetics of Particle and rigid body (Force and Acceleration)
Week 14	Hook's law, tension and compression stress
Week 15	Hook's law, tension and compression stress
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Workshop welding
Week 2	Workshop turning
Week 3	Workshop carpentry
Week 4	Workshop casting
Week 5	
Week 6	
Week 7	

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1. “Engineering Mechanics-Statics and Dynamics”, R.C. Hibbeler, 14th edition 2. “Engineering Mechanics-Statics and Dynamics”, J. L. Meriam and L. G. Kraige, 8th edition	
Recommended Texts	1. “Engineering Mechanics-Statics and Dynamics”, R.C. Hibbeler, 14th edition 2. “Engineering Mechanics-Statics and Dynamics”, J. L. Meriam and L. G. Kraige, 8th edition	
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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Human Rights</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">S</td><td colspan="2" rowspan="4">☒Theory
☒Lecture
☐Lab
☐Tutorial
☐Practical
☒Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">UM126</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">3</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">75</td></tr>
<tr><td colspan="2">Module Level</td><td>1</td><td colspan="2">Semester of Delivery</td><td>Two</td></tr>
<tr><td colspan="2">Administering Department</td><td>Electrical Dep.</td><td>College</td><td colspan="2">Engineering</td></tr>
<tr><td>Module Leader</td><td colspan="2"></td><td>e-mail</td><td colspan="2"></td></tr>
<tr><td colspan="2">Module Leader’s Acad. Title</td><td>Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td></td></tr>
<tr><td>Module Tutor</td><td colspan="2"></td><td>e-mail</td><td colspan="2"></td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td></td><td>e-mail</td><td colspan="2"></td></tr>
<tr><td colspan="2">Scientific Committee Approval Date</td><td>01/06/2023</td><td>Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td></td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td></td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	25. To gain an understanding of the philosophic and political backgrounds that underpin the concept of human rights, enabling students to grasp the multi-faceted nature of this complex field. 26. To learn about the significant historical documents that have contributed to the development and formation of human rights theories, enriching their knowledge of the history and evolution of human rights. 27. To engage in critical examination and discussion of current political and ethical debates surrounding human rights, fostering critical thinking and encouraging students to form their own perspectives on these issues. 28. To study key legal documents and understand the work of crucial governmental and non-governmental institutions currently involved in the protection and promotion of human rights. This objective aims to make students aware of the global landscape of human rights protection and how it operates. 29. To undertake a detailed examination of at least one current problem area in human rights protection, providing a practical application of knowledge and giving students a deeper understanding of the complexities and challenges faced in human rights protection. 30. To promote an understanding and appreciation of the importance of human rights in all areas of life, including engineering, highlighting the significance of ethical considerations in technical professions. 31. To encourage students to consider how their future work as engineers could potentially impact human rights, fostering a sense of social responsibility and ethical awareness in their professional practice. 32. To cultivate skills in research, analysis, and argumentation related to human rights, thereby enhancing students' overall academic and intellectual skills.
Module Learning Outcomes	38. Understand the historical, philosophical, and political context of human rights, appreciating the complexities and dimensions of the concept. 39. Be familiar with significant historical documents and milestones that have contributed to the evolution of human rights theories and their role in shaping the current understanding of human rights. 40. Analyze and articulate positions on contemporary political and ethical debates about human rights, demonstrating critical thinking skills and a broad understanding of the issues. 41. Identify and understand the roles of major governmental and non-governmental institutions in the promotion and protection of human rights, demonstrating an awareness of the broader global landscape of human rights advocacy. 42. Analyze a specific, current problem area in human rights protection, applying theoretical knowledge to real-world situations and demonstrating problem-

	solving skills. 43. Appreciate the relevance and importance of human rights considerations within their field of study, electrical engineering, and the broader engineering context. 44. Exhibit an understanding of the ethical responsibilities and potential impacts of engineering projects on human rights, preparing them to consider these factors in their future professional practice. 45. Show competence in researching, analyzing, and articulating arguments related to human rights, demonstrating development in academic skills applicable beyond this specific module. By achieving these learning outcomes, students will have not only a strong foundational understanding of human rights and its relevance to their discipline but also enhanced critical thinking and problem-solving skills.
Indicative Contents	Indicative content includes the following. 1. Introduces students to the philosophic and political background of the concept of human rights. 2. Discusses important documents as part of the history of the development of human rights theories. 3. Examines important issues in current political and ethical debates about human rights. 4. Reviews core legal documents and the work of the most important governmental and nongovernmental institutions currently involved in human rights protection and promotion. 5. Examines at least one current problem area in human rights protection

Learning and Teaching Strategies	
Strategies	1. Lectures: Traditional lectures will be used to introduce fundamental concepts, providing students with a strong theoretical foundation in the philosophic and political backgrounds of human rights, the history of human rights theories, and the role of various institutions in human rights protection and promotion. 2. Interactive Discussions: To facilitate critical thinking and engagement, class sessions will often involve interactive discussions. These might revolve around the analysis of important historical documents, current debates on human rights issues, or case studies of specific problem areas in human rights protection. 3. Group Projects: Students will work in groups to analyze a specific problem in

	human rights protection, encouraging teamwork, fostering a deeper understanding of the issue, and enabling students to apply theoretical knowledge to practical scenarios. 4. Guest Lectures: Inviting practitioners from the field, such as human rights activists, legal professionals, or engineers working on ethical issues, can provide students with real-world insights and inspire them to consider the impact of their work on human rights. 5. Research Assignments: Individual or group assignments might require students to conduct research on a specific topic related to human rights. This encourages independent learning, develops research skills, and deepens their understanding of the subject. 6. Case Studies: By analyzing and discussing real-world cases in class, students can understand the practical application of human rights theories, grasp the challenges faced in human rights protection, and consider the relevance of these issues in their own field of study. 7. Online Resources: Making use of online resources, such as academic articles, video lectures, podcasts, or documentaries, can supplement the course material and offer different perspectives on the subject matter. 8. Reflection Papers: Students could write reflection papers on how they see human rights intersecting with their engineering studies and future careers, promoting introspection and ethical awareness. These strategies aim to promote an active learning environment where students can deeply engage with the subject matter, enhancing their understanding and fostering important skills such as critical thinking, teamwork, research, and communication.

Student Workload (SWL)			
Structured SWL (h/sem)	33	**Structured SWL (h/w)**	2.2
Unstructured SWL (h/sem)	42	**Unstructured SWL (h/w)**	2.8
Total SWL (h/sem)	**75**		

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
	Report	1	20% (20)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**	2 hrs	10% (10)	7	LO #1 - #7
	Final Exam	3 hrs	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to the course: Overview of the module, its objectives, and learning outcomes. Introduction to the concept of human rights.
Week 2	Philosophical Background: An exploration of the philosophical principles that underpin the concept of human rights.
Week 3	Political Background: Discussion on the political history and influences on the development of human rights.
Week 4	Key Documents in Human Rights - Part I: Overview and analysis of significant historical documents related to human rights.
Week 5	Key Documents in Human Rights - Part II: Continued analysis of crucial historical documents, including their role in shaping current human rights theories. + Quiz
Week 6	Institutions and Human Rights: Examination of the roles of major governmental and non-governmental institutions in human rights protection.
Week 7	**Midterm Exam**
Week 8	In-depth study of current political and ethical debates in human rights - Part II: Continued discussion and analysis of contemporary debates, encouraging students to articulate positions.
Week 9	Guest Lecture: Inviting a practitioner in the field to provide real-world insights.
Week 10	Begin Group Project: Introduction of a specific current problem area in human rights protection for group projects. + Quiz

Week 11	Group Project Work: Class time allocated for group work on the project, with the instructor available for consultation and guidance.
Week 12	Group Project Presentations: Each group presents their analysis and proposed solutions to the class.
Week 13	Human Rights and Engineering - Part I: Introduction to the intersection of human rights and engineering.
Week 14	Human Rights and Engineering - Part II: Detailed exploration of case studies showcasing the impact of engineering projects on human rights.
Week 15	Course Review and Reflection: Review of the main themes covered in the course, discussion of the relevance of human rights to future careers in engineering, and submission of reflection papers.
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		
	Text	**Available in the Library?**
Required Texts	Donnelly, J. (2013). Universal Human Rights in Theory and Practice. Cornell University Press.	
Recommended Texts	Langlois, A.J. (2018). Human Rights: Protection and Promotion in the 21st Century. Routledge.	
Websites	https://www.ohchr.org/	

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

Module Information				
Module Title	Electrical Circuit I		Module Delivery	
Module Type	Core		☒Theory ☐Lecture ☐Lab ☒Tutorial ☐Practical ☐Seminar	
Module Code	EL211			
ECTS Credits	6			
SWL (hr/sem)	150			
Module Level	2	Semester of Delivery		Three
Administering Department	Electrical Dep.	College	Engineering	
Module Leader	Mohammed Kh. AL-Nussairi	e-mail	E-mail:muhammed.kh@uomisan.edu.iq	
Module Leader's Acad. Title	Associate Professor	Module Leader's Qualification		Ph.D.
Module Tutor	Mohammed Kh. AL-Nussairi	e-mail	E-mail:muhammed.kh@uomisan.edu.iq	
Peer Reviewer Name	Name	e-mail	E-mail	
Scientific Committee Approval Date	01/06/2023	Version Number	1.0	

Relation with other Modules			
Prerequisite module	fundamental of electrical engineering II	Semester	2
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	33. Provide a explanation of the concept of Laplace transform. 34. Distinguish between the functions of Laplace transform and inverse Laplace transform. 35. Determine the Laplace transform of standard functions. 36. Understand what a transfer function is and how it is used. 37. Determine the system poles and zeros. 38. Understand the natural response of the system. 39. Understand and use effectively circuit element models in the s-domain. 40. Understand how to perform circuit analysis in the s-domain and how to transform the results back into the time domain. 41. Explain transient condition that may occur in a network. 42. Explain transient condition in an R–L and R-C series/parallel circuit. 43. Make a complete analysis of transient condition of R–C series circuit on sudden application of a DC voltage. 44. Distinguish between steady state condition and transient condition with respect to voltage and current in a R–L and R–C series circuit with DC excitation. 45. Derive expressions for current and voltage under transient condition in a R–L–C series circuit on sudden application of a DC excitation. 46. List the steps to find transient response of electrical networks using Laplace transform. 47. Write differential equations of circuit variables in time domain and convert them into Laplace transform form. 48. Determine transient response of R – C and R-L circuits using Laplace transform and appreciate the method. 49. Define the two-port network parameters. 50. Write in terms of matrix equation the two-port network parameters. 51. Calculate Z-parameters, Y-parameters h-parameters, ABCD-parameters of two-port networks. 52. Explain two-port reciprocal network and symmetrical network. 53. Understand the principles of resonant circuits and their applications. 54. Analyze and calculate the behavior of series and parallel resonance. 55. Calculate the Q factor of resonant circuits.
Module Learning Outcomes	At the end of this module, students will be able to: 46. Analyze electrical network parameter for different application. 47. Apply the Laplace transform to linear circuits and systems. 48. Understand and be able to calculate: - dynamic analysis of RLC-circuits in frequency domain - current, voltage and power in circuits. 49. Develop Laplace Transformed network for steady state and transient analysis. 50. A good basis for analysis of electrical and electronic components in electronics, electric power engineering. 51. Determine the elements required to network synthesis methods.

	52. Calculate two port network parameters such as z, y, ABCD and h parameters for given electrical network. 53. Relate different two port network parameters. 54. Simplify the complex network such as cascade, parallel networks using fundamental two port network parameters. 55. Find the various driving point & transfer functions of two port network. 56. Understanding of resonant circuits in the field of electrical engineering. 57. Learn the principles and applications of resonant circuits, including analysis, design, and troubleshooting. 58. Develop the skills and knowledge necessary to design and optimize resonant circuits for various applications.
Indicative Contents	**Indicative content includes the following.** **<u>Part A: S- domain Circuit Analysis</u>** **Definition of the Laplace Transform, Properties of the Laplace Transform, The Inverse Laplace Transform, Impedance and admittance in s-domain, circuit analysis in s-domain. [15 hrs]** **<u>Part B: Transfer Function</u>** **Definition of the transfer function, Poles and zeros of transfer functions, natural response and s-plane.** **<u>Part C: The Transient Circuits</u>** **RC, RL, RLC circuit in series and parallel and their complete response in time and s-domain. [15 hrs]** **<u>Part D: Two-Port Networks</u>** **Two-port networks, y-z-h and ABCD parameters, Parameter relationships y-z-h and ABCD parameters, Cascaded two-ports, Series and parallel connections of two-ports.** **<u>Part E:Resonance</u>** **Series Resonance: quality factor – selectivity – half power – frequency and bandwidth, Parallel Resonance: quality factor – selectivity – half power – frequency and bandwidth, series / parallel resonance circuits.**

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 types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	**78**	**Structured SWL (h/w)**	**5.2**
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**	**4**	**20% (20)**	**4,8,10, and 12**	**LO #1, #2 and #10, #11**
	Assignments	**1**	**10% (10)**	**11**	**LO #3, #4 and #6, #7**
	Projects / Lab.		**10% (10)**	**Continuous**	**All**
	Report		**10% (10)**	**13**	**LO #5, #8 and #10**
Summative assessment	**Midterm Exam**	**1.5hr.**	**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	Introduction to Laplace Transform, Selected Function Laplace Transforms, Properties of Laplace Transform and pairs
Week 2	Laplace Inverse, Circuit Elements in S Domain
Week 3	Electrical Circuit Analysis Using Laplace Transform
Week 4	Introduction to Transfer Function, System Poles and Zeros, Electrical Circuit in Transfer Function
Week 5	S-Plane, Natural Response
Week 6	Introduction to The Transient Circuits, The Transient analysis of R-C circuit
Week 7	The Transient analysis of R-C circuit, The Transient analysis of R-L-C circuit
Week 8	Transient Analysis Using Laplace Transform
Week 9	Mid term
Week 10	Introduction to TWO-PORT NETWORKS, Input impedance, output impedance, voltage gain, current gain and power gain
Week 11	Admittance parameters, Impedance parameters, Hybrid parameters, Transmission parameters
Week 12	Conditions for Reciprocity and Symmetry, Interrelationships between Two-Port Parameters
Week 13	Interconnection of Two-Port Networks, Two-Port Network Functions, Some Special Two-Port Networks
Week 14	Series Resonance: quality factor – selectivity – half power – frequency and bandwidth
Week 15	Parallel Resonance: quality factor – selectivity – half power – frequency and bandwidth, series / parallel resonance circuits
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	**Electric Circuits, James W. Nilsson, Susan A. Riedel, Pearson.** **Circuit Analysis: Theory and Practice, Allan H. Robbins and Wilhelm C. Miller**	
Recommended Texts	**Fundamentals of Electric Circuits, C.K. Alexander and M.N.O Sadiku, McGraw-Hill Education**	
Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering	

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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>**Module Title**</td><td colspan="2">Electrical Machine I</td><td colspan="3">**Module Delivery**</td></tr>
<tr><td>**Module Type**</td><td colspan="2">**Core**</td><td colspan="3" rowspan="4">☒Theory
☒ Lecture
☐ Lab
☒ Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>**Module Code**</td><td colspan="2">EL212</td></tr>
<tr><td>**ECTS Credits**</td><td colspan="2">**5**</td></tr>
<tr><td>**SWL (hr/sem)**</td><td colspan="2">**125**</td></tr>
<tr><td colspan="2">**Module Level**</td><td>2</td><td colspan="2">**Semester of Delivery**</td><td>3</td></tr>
<tr><td colspan="2">**Administering Department**</td><td>Electrical Dep.</td><td>**College**</td><td colspan="2">Engineering</td></tr>
<tr><td>**Module Leader**</td><td colspan="2">Zahraa Dawood</td><td>**e-mail**</td><td colspan="2">zahraadawood12@gmail.com</td></tr>
<tr><td colspan="2">**Module Leader's Acad. Title**</td><td>Lecturer</td><td colspan="2">**Module Leader's Qualification**</td><td>M.Sc.</td></tr>
<tr><td>**Module Tutor**</td><td colspan="2">Zahraa Dawood</td><td>**e-mail**</td><td colspan="2">zahraadawood12@gmail.com</td></tr>
<tr><td colspan="2">**Peer Reviewer Name**</td><td></td><td>**e-mail**</td><td colspan="2"></td></tr>
<tr><td colspan="2">**Scientific Committee Approval Date**</td><td>/ /2023</td><td>**Version Number**</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>**Prerequisite module**</td><td>None</td><td>**Semester**</td><td></td></tr>
<tr><td>**Co-requisites module**</td><td>None</td><td>**Semester**</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	The module aims to do the following: 1. To Understand the fundamental principles that govern the operation of electrical machines such as transformers, motors, and generators. 2. To develop the ability to analyze and design electrical machines by studying their construction, characteristics, and performance parameters. 3. To develop the ability of students to analyze the performance parameters of electrical machines, such as torque, power, efficiency, and voltage regulation. 4. To understand the control mechanisms and operational aspects of electrical machines, including speed control methods. 5. Electrical machines are integral parts of various systems, such as power generation, transmission, and industrial processes. Students should comprehend the integration and coordination of electrical machines within these systems.
Module Learning Outcomes	1. Understand working principles of DC generators, including the basic construction, essential components, such as the armature, field winding, brushes, and commutator. 2. Different types of DC generators are studied, including separately excited generators, shunt-wound generators, series-wound generators, and compound-wound generators. 3. Understand the efficiency of a DC generator and identifying different types of losses (copper, iron, mechanical, etc.) 4. Understand Armature reaction refers to the magnetic field distortion caused by the armature current and Commutation process. 5. Apply EMF equation to solve different type of generator circuit. 6. Ability to analysis and discus the various characteristics of DC generators, such as open-circuit characteristic, magnetization characteristic and load characteristic. 7. Understand the parallel operation of dc generator and determine the output to the load. 8. Analysis and determine motor's parameters such as back emf, torque, speed, and horsepower. 9. Analyzing the key characteristics of DC motors, such as torque-speed relationship, efficiency, and output power. 10. Understand the methods of controlling DC motors, such as armature voltage control and field weakening. 11. Understand the various methods and techniques of braking of dc motor. 12. Understand and apply various method of test machine calculations.
Indicative Contents	Indicative content includes the following (**4 hours per week**) Week 1: Introduction, Construction of DC Machines • Understanding the Working of DC Generators • Simple Loop Generator • Construction and Components of DC Generators • function of commutator

	Week 2: Type of Generator, Armature Winding, EMF Equation • Type of armature windings (Lap and Wave Winding) • Type of excitation connections • E.M.F. Equation of a Generator • Calculation of induced emf Week 3: Total Losses, Distribution of Power, Efficiency • Total loss in a D.C. Generator (Iron Loss in Armature, Stray Losses, Constant Losses) • Power Stages • Condition for Maximum Efficiency Week 4: Armature Reaction, Compensating Windings, Commutation • Armature Reaction • Analyze Demagnetizing and Cross-magnetizing conductor • Calculation of Demagnetizing and Cross- magnetizing Ampere-Turns Per Pole (AT/Pole) • Compensating Windings Week 5: Commutation, Generator Characteristics • Commutation • Methods of Improving Commutation • Characteristics of D.C. Generators. • Characteristics of Separately excited Generator Week 6: O.C.C. characteristics, Voltage Build-up, • Voltage Build-up of a Shunt Generator • No-load Curve for Self-excited Generator • Critical Speed, Critical resistance Week 7: Mid Term Exam Week 8: Series Generator Characteristics, Voltage regulation, Paralleling DC Generators • Characteristics of series generator • Parallel Operation of Shunt Generators • Load sharing • Analyzing and calculate out power in DC power plant. Week 9: DC Motor, Back EMF • Motor Principle • Significance of the Back e.m.f. Voltage Equation of a Motor • Conditions for Maximum Power

	Week 10: Speed, Torque, Characteristics • Speed of a D.C. Motor • Torque (Armature Torque of a Motor, Shaft Torque) • Characteristics of shunt, series, and compound motor Week 11: Losses, Control method • Losses, Efficiency, and Power stage • Factors Controlling Motor Speed • Control speed method Week 12: • Speed Control of Shunt Motors Week 13: • Speed Control of Series Motors Week 14: Starting, Braking • Starting of Motors • Electric Braking Week 15: Testing of DC Machines • Swinburne's Test • Hopkinson's Test

Learning and Teaching Strategies	
Strategies	1. **Lecture method:** In this traditional strategy, the teacher presents information through verbal communication, supplemented with visual aids or demonstrations. 2. **Active learning:** Encourages student engagement through participation, discussion, and problem-solving activities rather than passive listening. 3. **Flipped classroom:** Students engage with instructional materials outside of class (e.g., watching videos, reading texts) and then use class time for activities, discussions, and personal interaction with the teacher. 4. **Assessments**: Implement regular formative assessments, such as quizzes, assignments, and in-class exercises, to evaluate students' understanding and progress. Provide constructive feedback to guide their learning and address any misconceptions. 5. **Review Sessions**: Before exams or major assessments, conduct review sessions to summarize key concepts, address common challenges, and provide additional practice problems. This helps consolidate knowledge and reinforces understanding.

	6. **Mid-term Exam**: Administer a mid-term exam to assess students' comprehension of the topics covered in the first half of the module. This exam can help identify areas that require further clarification or reinforcement. 7. **Final Exam**: Conduct a comprehensive final exam to assess students' overall understanding of the module's content. Design the exam to incorporate a variety of question formats, including theoretical concepts, problem-solving, and circuit analysis.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4.2
Unstructured SWL (h/sem)	62	**Unstructured SWL (h/w)**	3.1
Total SWL (h/sem)	**125**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	10% (10)	4,6 and 12	LO #3, #4, and #10
	Assignments	3	10% (10)	3,6 and 12	LO #3, #7 and #10
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #1 - #11
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)	
	Material Covered
Week 1	Introduction, Construction of DC Machines
Week 2	Type of Generator, Armature Winding, EMF Equation
Week 3	Total Losses, Distribution of Power, Efficiency
Week 4	Armature Reaction, Compensating Windings, Commutation
Week 5	Commutation, Generator Characteristics
Week 6	O.C.C. characteristics, Voltage Build-up
Week 7	Mid Term Exam
Week 8	Series Generator Characteristics, Voltage regulation, Paralleling DC Generators
Week 9	DC Motor, Back EMF
Week 10	Speed, Torque, Characteristics
Week 11	Losses, Control method
Week 12	Speed Control of Shunt Motors
Week 13	Speed Control of Series Motors
Week 14	Starting, Braking
Week 15	Testing of DC Machines
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Electrical Technology, B.L. Theraja, Volume-II (AC & DC Machines)	Yes
Recommended Texts	Principles of Electrical Machines By V. K. Mehta, Rohit Mehta	No

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

Module Information					
Module Title	Mathematics III			Module Delivery	
Module Type	Basic			☒Theory ☐Lecture ☐Lab ☒Tutorial ☐Practical ☐Seminar	
Module Code	EE213				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	2		Semester of Delivery		3
Administering Department	Elect. Eng. Dept.		College	Engineering	
Module Leader	Nabeel Najm Bahlol Al-Mayyahi		e-mail	nabeelclick@uomiasn.edu.iq	
Module Leader's Acad. Title	lecturer		Module Leader's Qualification		M.Sc.
Module Tutor			e-mail		
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date	01/06/2023		Version Number	1.0	

Relation with other Modules			
Prerequisite module	EE122	Semester	2
Co-requisites module	None	Semester	

<table>
<tr><th colspan="2">Module Aims, Learning Outcomes and Indicative Contents</th></tr>
<tr><td>Module Objectives</td><td>This course, Mathematics III, is specifically designed for undergraduate students in the field of Electrical Engineering. After completing this module, students should have developed a clear understanding of the fundamental concepts of Mathematics and a range of skills allowing them to work effectively with the concepts. The basic concepts are:
1) Vectors and Geometry of Space such as the topics of scalars and vectors, component of a vector, rules of vector arithmetic, norm of a vector, normalizing of vectors, dot product, cross product, product of three or more vectors, and equations of lines in space, planes in 3-space.

2) Vector-valued functions (Vector Functions) such as the topics of limits and continuity, derivatives, forms of a curve equation in space, parametric representation, unit tangent and normal vectors, curvature, radius of curvature, motion along a curve, velocity, acceleration and speed, and normal and tangential components of acceleration.

3) Partial Derivatives (Differentiations) such as the topics of Function of two or more variables, limits and continuity, partial derivatives, partial derivatives of functions of two variables, partial derivatives of functions with more than two variables, the chain rule, the chain rule for derivatives, the chain rule for partial derivatives, directional derivatives and gradients, directional derivatives, the gradient, tangent plans and normal vectors, maxima and minima of functions of two variables, and Lagrange multipliers.

4) Multiple integrals such as the topics of Double integral, areas and volumes, double integral in polar coordinates, parametric surfaces, surface area, surface integrals, and evaluation of volume and triple integral.</td></tr>
<tr><td>Module Learning Outcomes</td><td>After completing this module, students should demonstrate competency in the following skills:

1) Be able to determine vectors addition, subtraction and multiplication.
2) Be able to understand the applications of the vectors such as force, velocity and acceleration.
3) Understand the concept of partial differential, partial derivative and directional derivative.
4) Be able to calculate gradient, divergence and derivative and understand their applications.
5) Calculate the linearization of functions and determine maxima, minima and saddle points
6) Be able to Determine areas and volumes of functions using multiple integration methods.</td></tr>
</table>

Indicative Contents	**Indicative contents (Course Outline) include the following: -** **(i) Vectors and Geometry of Space.** scalars and vectors, component of a vector, rules of vector arithmetic, norm of a vector, normalizing of vectors, dot product, cross product, product of three or more vectors, equations of lines in space, planes in 3-space. **(ii) Vector-valued functions (Vector Functions)** limits and continuity, derivatives, forms of a curve equation in space, parametric representation, unit tangent and normal vectors, curvature, radius of curvature, motion along a curve, velocity, acceleration and speed, normal and tangential components of acceleration. (iii) **Partial Derivatives (Differentiations)** Function of two or more variables, limits and continuity, partial derivatives, partial derivatives of functions of two variables, partial derivatives of functions with more than two variables, the chain rule, the chain rule for derivatives, the chain rule for partial derivatives, directional derivatives and gradients, directional derivatives, the gradient, tangent plans and normal vectors, maxima and minima of functions of two variables, Lagrange multipliers. **(iv) Multiple integrals** Double integral, areas and volumes, double integral in polar coordinates, parametric surfaces, surface area, surface integrals, evaluation of volume and triple integral.

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 types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	78	**Structured SWL (h/w)**	5.2
Unstructured SWL (h/sem)	47	**Unstructured SWL (h/w)**	3.1
Total SWL (h/sem)	**125**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	4	20% (20)	4,8,12, and 15	All
	Assignments	15	20% (20)	1-15	All
Summative assessment	**Midterm Exam**	2 hrs.	10% (10)	8	LO #1 and 2
	Final Exam	3 hrs.	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**Vectors and Geometry of Space** Scalars and vectors, component of a vector, rules of vector arithmetic, norm of a vector, normalizing of vectors. Assignment No.1
Week 2	**Vectors and Geometry of Space** Dot product, Cross product. Assignment No.2
Week 3	**Vectors and Geometry of Space** Product of three or more vectors Assignment No.3
Week 4	**Vectors and Geometry of Space** Equations of lines in space, planes in 3-space. Assignment No.4 Quiz No.1
Week 5	**Vector-valued functions (Vector Functions)** Limits and continuity, derivatives, forms of a curve equation in space Assignment No.5
Week 6	**Vector-valued functions (Vector Functions)**

	parametric representation, unit tangent and normal vectors. Assignment No.6
Week 7	**Vector-valued functions (Vector Functions)** Curvature, radius of curvature, motion along a curve, velocity, acceleration and speed Assignment No.7
Week 8	**Vector-valued functions (Vector Functions)** Normal and tangential components of acceleration. Assignment No.8 Quiz No.2 **Midterm Exam**
Week 9	**Partial Derivatives (Differentiations)** Function of two or more variables, limits and continuity, partial derivatives. Assignment No.9
Week 10	**Partial Derivatives (Differentiations)** partial derivatives of functions of two variables, partial derivatives of functions with more than two variables. Assignment No.10
Week 11	**Partial Derivatives (Differentiations)** the chain rule for derivatives, the chain rule for partial derivatives, directional derivatives and gradients, directional derivatives, the gradient, Assignment No.11
Week 12	**Partial Derivatives (Differentiations)** maxima and minima of functions of two variables, Lagrange multipliers. Assignment No.12 Quiz No.3
Week 13	**Multiple integrals** Double integral, areas and volumes, double integral in polar coordinates Assignment No.13
Week 14	**Multiple integrals** Parametric surfaces, surface area, surface integrals Assignment No.14
Week 15	**Multiple integrals** Evaluation of volume and triple integral. Assignment No.15 Quiz No.4
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Thomas, G. B., Weir, M. D., Hass, J., Heil, C., & Behn, A. (2016). *Thomas' Calculus Early Transcendentals*. Pearson.	Yes
Recommended Texts		
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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Electronic Circuit</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">C</td><td colspan="2" rowspan="4">☒Theory
☐Lecture
☒ Lab
☒ Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">EL214</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">125</td></tr>
<tr><td colspan="2">Module Level</td><td>2</td><td colspan="2">Semester of Delivery</td><td>3</td></tr>
<tr><td colspan="2">Administering Department</td><td>Electrical Dep.</td><td>College</td><td colspan="2">Engineering</td></tr>
<tr><td>Module Leader</td><td colspan="2">Maab alaa hussein</td><td>e-mail</td><td colspan="2">maab-alaa @uomisan.edu.iq</td></tr>
<tr><td colspan="2">Module Leader's Acad. Title</td><td>Lecture</td><td colspan="2">Module Leader's Qualification</td><td>M.Sc</td></tr>
<tr><td>Module Tutor</td><td colspan="2">Name (if available)</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Name</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Scientific Committee Approval Date</td><td>01/06/2023</td><td>Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>EE113</td><td>Semester</td><td>1</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	***The goal of this course is to establish a background on:*** - Amplifier design, specifically on BJT- and MOSFET-based amplifiers used in discrete circuits and integrated circuits, namely the microelectronic circuits. - Some useful integrated circuit elements based on these two transistors will be introduced and analyzed - The course also aims to cover the differential and multistage amplifiers. - In this course also other two terminal devices like schottky diodes , power diodes and others are explained. - PnPn and other devices are decrypted and explained their operations.
Module Learning Outcomes	- Identify the main circuit elements and draw a electronic circuit diagram corresponding to a physical combination of standard electronic components - explain the properties and operations of BJTs (bipolar junction transistors). express that BJT is a P-N junction circuit element and its terminals are called as Emitter, Base and Collector. polarize a BJT using two sources and calculates various current, voltage values and also the power dissipated in a transistor. - Definition of small signal in transistor. - Be able to know the amplifier configurations for both BJT and FET . - explain the properties and operations of FETs (field effect transistors) and explain the structure and types of JFETs. - Be able to draw the transfer characteristics curve and explains forward conduction using this curve. - Explain the differences between D-MOSFETs and JFETs, and also E-MOSFETs and JFETs and likeness between D-MOSFETs JFETs. - Be able to analyze both BJT and FET circuits an ac analysis and calculate voltage gain, current gain input impedance and output impedance. - Identify and analyze the differential and multistage amplifiers . - Other two terminal devices also explained for the students and they be able to use them in their life. - PnPn and other devices are desecrated like : Diac,GTO, and Triac.
Indicative Contents	***Indicative content includes the following.*** ***<u>Part A – BJT Circuit Theory</u>*** Describe the main functions of a transistor (to amplify ac and dc signals); Describe the operation of the following types of transistors (NPN, PNP or field-effect transistor (FET)); explain the operation of a common emitter amplifier . stabilized biasing; Explain the terms ‘input impedance, output impedance , voltage gain and ‘current gain. ***<u>Part B -FET Analogue Electronics</u>*** Two types of FETs will be introduced: the junction field-effect transistor (JFET) and the metal-oxide-semiconductor field-effect transistor (MOSFET). The MOSFET category is further broken down into depletion and enhancement types, which are both described. The MOSFET transistor has become one of the most important devices used in the design and construction of integrated circuits for digital computers. ***<u>Part C –Differential and Multistage Amplifiers</u>***

	Determining voltage gain of Multistage Amplifiers: Learner is introduced to the use of the dB unit as applied to represent gain of amplifiers and perform calculations for total gain of amplifiers connected in cascade and drawing equivalent circuits of amplifiers. ***Part D- Other Two-Terminal Devices*** Explained their circuit diagrams and operations. ***Part E- PnPn Devices*** Explained their circuit diagrams and operations.

Learning and Teaching Strategies	
Strategies	Type something like: 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.

Student Workload (SWL)			
Structured SWL (h/sem)	79	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	46	**Unstructured SWL (h/w)**	5
Total SWL (h/sem)	**125**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	20% (20)	4,7, and 9	LO #1, #2 and #10, #11
	Assignments	3	5% (5)	3,6 and 11	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	5% (5)	14	LO #5, #8 and #10
Summative	**Midterm Exam**	2 hrs	10% (10)	7	LO #1 - #7

assessment	**Final Exam**	3 hrs	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction of amplification with transistors
Week 2	BJTs Transistors : small signal analysis
Week 3	BJTs Transistors : small signal analysis
Week 4	BJTs Transistors : small signal analysis
Week 5	FETs Transistor : small signal analysis
Week 6	FETs Transistor : small signal analysis
Week 7	FETs Transistor : small signal analysis
Week 8	FETs Transistor : small signal analysis
Week 9	Differential Amplifiers
Week 10	Multistage Amplifiers
Week 11	Multistage Amplifiers
Week 12	Multistage Amplifiers
Week 13	Other Two Terminal Devices
Week 14	Other Two Terminal Devices
Week 15	PnPn Devices and Others
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Introduction
Week 2	Diode characteristics
Week 3	Zener diode characteristics.
Week 4	P-N junction diode as half-wave rectifier.
Week 5	P-N junction diode as Full -wave rectifier.
Week 6	P-N junction diode as full -wave bridge rectifier.
Week 7	clipping and clamping circuits.

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 9th Edition, Pearson Education / PHI, 2007.	*yes*
Recommended Texts	1.Millman J and Halkias .C., Integrated Electronics, TMH, 2007. 2. S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, Electronic Devices and Circuits, 2 nd Edition, TMH, 2007. 29 3.David A. Bell, Electronic Devices & Circuits, 4th Ediion, PHI, 2007	*yes*
Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering	

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

Module Information					
Module Title	Computer Programming (Python)		Module Delivery		
Module Type	Core		☒Theory ☐Lecture ☒Lab ☒Tutorial ☐Practical ☐Seminar		
Module Code	EL215				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	2		Semester of Delivery		Three
Administering Department	Electrical Dep.		College	Engineering	
Module Leader	Dr. Haider Khalaf Allamy		e-mail	Haider.allamy@uomisan.edu.iq	
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification		Ph.D.
Module Tutor			e-mail		
Peer Reviewer Name			e-mail		
Scientific Committee Approval Date	01/06/2023		Version Number	1.0	

Relation with other Modules			
Prerequisite module	UM114	Semester	1
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. To demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries. 2. To understand about Functions, Modules and Regular Expressions in Python Programming. 3. To build basic programs using fundamental programming constructs like variables, conditional logic, looping, and functions. 4. Work with user input to create fun and interactive programs. 5. To be able to introduce core programming basics and various Operators of Python programming language. 6. To demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries 7. To understand about Functions, Modules and Regular Expressions in Python Programming.
Module Learning Outcomes	The students should be able to 1. Understand basic principles of computers 2. Understand basics of binary computation 3. Understand the programming basics (operations, control structures, data types, etc.) 4. Student should be able to understand the basic concepts of scripting and the contributions of scripting language. 5. Ability to explore python data structures like Lists, Tuples, Sets and dictionaries. 6. Ability to create practical and contemporary applications using Functions, Modules and Regular Expressions. 7. Readily use the Python programming language 8. Apply various data types and control structure 9. Understand class inheritance and polymorphism 10. Understand the object-oriented program design and development 11. Understand and begin to implement code. **Course Description** Introduction to programming basics (what it is and how it works), binary computation, problem-solving methods and algorithm development. Includes procedural and data abstractions, program design, debugging, testing, and documentation. Covers data types, control structures, functions, parameter passing, library functions, arrays, inheritance and object oriented design. Laboratory exercises in Python.
Indicative Contents	**Module 1:** Introduction -- Relationship between computers and programs -- Basic principles of computers -- File systems -- Using the Python interpreter -- Introduction to binary computation -- Input / Output. **Module 2:** Data types and control structures -- Operators (unary, arithmetic, etc.) -- Data types, variables, expressions, and statements -- Assignment statements -- Strings and string operations -- Control Structures: loops and decision. **Module 3**: Modularization and Classes -- Standard modules -- Packages -- Defining

	Classes -- Defining functions -- Functions and arguments (signature). **Module 4:** Exceptions and data structures -- Data Structures (array, List, Dictionary) -- Error processing -- Exception Raising and Handling. **Module 5**: Object oriented design -- Programming types -- Object Oriented Programming -- Object Oriented Design -- Inheritance and Polymorphism. **Module 6**: Remaining materials.

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 types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	64	**Structured SWL (h/w)**	4.2
Unstructured SWL (h/sem)	61	**Unstructured SWL (h/w)**	4
Total SWL (h/sem)	**125**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	5 and 10	LO #1, #2 and #7, #6
	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	**Module 1:** Introduction -- Relationship between computers and programs -- Basic principles of computers -- File systems -- Using the Python interpreter
Week 2	-- Introduction to binary computation -- Input / Output.
Week 3	**Module 2:** -- Data types and control structures -- Operators (unary, arithmetic, etc.)
Week 4	-- Data types, variables, expressions, and statements -- Assignment statements
Week 5	-- Strings and string operations -- Control Structures: loops and decision.
Week 6	**Quiz**
Week 7	**Mid- term + Module 3**: --Modularization and Classes -- Standard modules -- Packages
Week 8	-- Defining Classes
Week 9	-- Defining functions
Week 10	-- Error processing -- Exception Raising and Handling.
Week 11	**Module 5**: --Object oriented design –- Programming types.
Week 12	-- Object Oriented Programming -- Object Oriented Design
Week 13	-- Inheritance and Polymorphism.
Week 14	**Quiz**
Week 15	**Module 6**: Remaining materials.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Demonstrate about Basics of Python Programming.
Week 2	Demonstrate about fundamental Data types in Python Programming. (i.e., int, float, complex, bool and string types)
Week 3	Demonstrate the working of following functions in Python. i) id( ) ii) type( ) iii) range( )
Week 4	Write a Python program to demonstrate various base conversion functions.
Week 5	Write a Python program to demonstrate various type conversion functions.
Week 6	Demonstrate the following Operators in Python with suitable examples. i) Arithmetic Operators ii) Relational Operators iii) Assignment Operator iv) Logical Operators v) Bit wise Operators vi) Ternary Operator vii) Membership Operators viii) Identity Operators
Week 7	Write Python programs to demonstrate the following: i) input( ) ii) print( ) iii) 'sep' attribute iv) 'end' attribute v) replacement Operator ({ })
Week 8	Demonstrate the following Conditional statements in Python with suitable examples. i) if statement ii) if else statement iii) if – elif – else statement
Week 9	Demonstrate the following Iterative statements in Python with suitable examples. i) while loop ii) for loop
Week 10	Demonstrate the following control transfer statements in Python with suitable examples. i) break ii) continue iii) pass
Week 11	Write Python programs to print Patterns:
Week 12	Write a Python program to demonstrate various ways of accessing the string. i) By using Indexing (Both Positive and Negative) ii) By using Slice Operator
Week 13	Demonstrate the following functions/methods which operates on strings in Python with suitable examples: i) len( ) ii) strip( ) iii) rstrip( ) iv) lstrip( )

	v) find( ) vi) rfind( ) vii) index( ) viii) rindex() ix) count( ) x) replace( ) xi) split( ) xii) join( ) xiii) upper( ) xiv) lower( ) xv) swapcase( ) xvi) title( ) xvii) capitalize( ) xviii) startswith() xix) endswith()
Week 14	Python program to perform read and write operations on a file.

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	"Starting Out with Python plus MyProgrammingLab with Pearson eText --Access Card Package (3rd Edition) Tony Gaddis ISBN-13: 978-0133862256"	yes
Recommended Texts	1. Learning Python, Mark Lutz, Orielly, 3 Edition 2007. 2. Python Programming: A Modern Approach, Vamsi Kurama, Pearson, 2017.	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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="2">Digital Technical I</td><td colspan="3">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="2">Core</td><td colspan="3" rowspan="5">☒ Theory
☐Lecture
☐Lab
☒Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="2">EL216</td></tr>
<tr><td>ECTS Credits</td><td colspan="2">4</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="2">100</td></tr>
<tr></tr>
<tr><td>Module Level</td><td colspan="2">2</td><td colspan="2">Semester of Delivery</td><td>Three</td></tr>
<tr><td>Administering Department</td><td colspan="2">Electrical Dep.</td><td>College</td><td colspan="2">Engineering</td></tr>
<tr><td>Module Leader</td><td colspan="2">Dr. Haider Khalaf Allamy</td><td>e-mail</td><td colspan="2">Haider.allamy@uomisan.edu.iq</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td colspan="2">Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td>Ph.D.</td></tr>
<tr><td>Module Tutor</td><td colspan="2"></td><td>e-mail</td><td colspan="2"></td></tr>
<tr><td>Peer Reviewer Name</td><td colspan="2"></td><td>e-mail</td><td colspan="2"></td></tr>
<tr><td>Scientific Committee Approval Date</td><td colspan="2">01/06/2023</td><td>Version Number</td><td colspan="2">1.0</td></tr>
</table>

Relation with other Modules			
Prerequisite module	None	Semester	
Co-requisites module	EL226	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1) To develop problem solving skills and understanding of Digital Systems through The application of techniques. 2) To understand Digital signals and the difference from Analogue signals. 3) To cover the basic concept of Boolean Algebra. 4) To establish the basic concepts of Digital Combinational Circuits Design.
Module Learning Outcomes	1) Students should be able to explain about digital number systems. 2) Students should be able to explain about Logic circuits. 3) The student should be able to introduce the methods for simplifying Boolean expressions. 4) To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
Indicative Contents	Indicative content includes the following. -Introduction to Digital Techniques: Basic: **3 Hours** Digital Systems: Digital systems, Digital Signals, Analogue systems, Analogue signals, Examples -Definitions, System of Numbers: **12 Hours** General number formula: Binary, octal, decimal and hexadecimal numbers. Numbers Base Conversion: Arithmetic operations in different number system, complements, binary codes, BCD, Ex-3, Gray codes -Standard forms Digital Logic Gates: **12 Hours** Logic Gates: AND, OR, NOT, NAND, NOR, Exclusive–OR and Exclusive–NOR Implementations of Logic Functions using gates, NAND–NOR implementations – Multi level gate implementations- Multi output gate implementations. -Boolean Algebra: **6 Hours** Boolean Algebra, Basic definitions, basic theorem and properties, Boolean functions. -MINIMIZATION TECHNIQUES AND LOGIC GATES: **12 Hours** Minimization Techniques: Boolean postulates and laws– De-Morgan's Theorem - Principle of Duality - Boolean expression - Minimization of Boolean expressions –– Minterm – Maxterm - Sum of Products (SOP) – Product of Sums (POS) – Karnough's diagram, Karnaugh map: AND- OR implementation, don't care

Learning and Teaching Strategies	
Strategies	The main strategy that will be adopt 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 achieve through classes, interactive tutorials and by considering types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	48	**Structured SWL (h/w)**	3.2
Unstructured SWL (h/sem)	52	**Unstructured SWL (h/w)**	3.4
Total SWL (h/sem)	**100**		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Digital Techniques: Basic: Digital systems, Digital Signals, Analogue systems, Analogue signals, Examples.
Week 2	Definitions, System of Numbers: General number formula: Binary and octal numbers.
Week 3	Decimal and hexadecimal numbers.
Week 4	Numbers Base Conversion: Arithmetic operations in different number system.
Week 5	Complements, binary codes, BCD, Ex-3, Gray codes.
Week 6	Standard forms Digital Logic Gates: Logic Gates: AND, OR, NOT, NAND and NOR.
Week 7	Mid-term + Exclusive–OR and Exclusive–NOR Implementations of Logic Functions using gates>
Week 8	NAND–NOR implementations – Multi level gate implementations.
Week 9	Multi output gate implementations.
Week 10	Boolean Algebra:

	Boolean Algebra, Basic definitions, basic theorem and properties.
Week 11	Boolean functions.
Week 12	MINIMIZATION TECHNIQUES AND LOGIC GATES: Minimization Techniques: Boolean postulates and laws – De-Morgan's Theorem -Principle of Duality.
Week 13	Boolean expression - Minimization of Boolean expressions —Minterm – Maxterm.
Week 14	Sum of Products (SOP) – Product of Sums (POS) – Karnough's diagram.
Week 15	Karnaugh map: AND- OR implementation, don't care.
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		
	Text	**Available in the Library?**
Required Texts	Thomas L. Floyd, Digital Fundamentals, 9th Edition	yes
Recommended Texts		
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

Module Information				
Module Title	**Electrical Circuit II**		**Module Delivery**	
Module Type	**Core**		☒Theory ☐Lecture ☐Lab ☒Tutorial ☐Practical ☐Seminar	
Module Code	**EL221**			
ECTS Credits	**6**			
SWL (hr/sem)	150			
Module Level	**2**	**Semester of Delivery**	**Four**	
Administering Department	Electrical Dep.	**College**	Engineering	
Module Leader	**Mohammed Kh. AL-Nussairi**	**e-mail**	E-mail:muhammed.kh@uomisan.edu.iq	
Module Leader's Acad. Title	**Associate Professor**	**Module Leader's Qualification**	**Ph.D.**	
Module Tutor	**Mohammed Kh. AL-Nussairi**	**e-mail**	E-mail:muhammed.kh@uomisan.edu.iq	
Peer Reviewer Name	Name	**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023	**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	56. Understand that a current-carrying conducting coil induces a current in another coil due to the magnetic field produced by the first coil. 57. Relate an induced emf to a rate of change of magnetic flux and to mutual inductance for two coils with equal number of turn. 58. Understand the physics behind mutually coupled circuits and how to analyze circuits containing mutually coupled inductors. 59. Understand how linear transformers work and how to analyze circuits containing them. 60. Understand how ideal transformers work and how to analyze circuits containing them. 61. Understand how ideal auto transformers work and know how to analyze them when used in a variety of circuits. 62. Explain the basic function of a filter circuit. 63. Distinguish between a passive filter and an active filter. 64. Classify passive filters and explain function of each type of filter. 65. Explain the parameters of a filter. 66. Make analysis of constant K-type or proto-type filters. 67. Solve problems on constant K-type filters. 68. Design different filters. 69. Understand the concept of Network synthesis.. 70. To understand the basic working principles of electrical and electronic measuring instruments. 71. To learn the ways of presenting and interpreting results. 72. To calculate the uncertainty of the direct and indirect single and multiple measurements. 73. To introduce students to monitor, analyze and control any electrical system. 74. To understand students how different types of meters work and their construction. 75. To provide a student a knowledge to design and create novel products and solutions for real life problems. 76. To introduce students a knowledge to use modern tools necessary for electrical projects.
Module Learning Outcomes	At the end of this module, students will be able to: 59. Define mutual inductance and coupling coefficient. 60. Explain the dot convention rule. 61. Determine the mutual inductance of inductors in series and parallel. 62. Demonstrate the refer to primary and secondary techniques to solve for voltages and currents of an ideal transformer. 63. Drive the transfer function and cutoff frequency of all passive filters. 64. Understand the benefit and characteristic of all passive filter. 65. Develop the knowledge of theoretical and mathematical principles of electrical measuring instruments.

	66. Examine various real life situations in domestic or industrial scenario where measurements of electrical quantities are essential. 67. Choose the proper type and specification of measuring procedure and measuring instruments for different industrial/commercial/domestic plications. 68. Design new sensing and measuring schemes for various electrical and electronic applications.
Indicative Contents	Indicative content includes the following. Part A: Coupling Circuits Magnetic coupling, coefficient of coupling, equivalent circuit's linear, ideal transformers, autotransformer. [15 hrs] Part B: Filters Constant k-filters, low pass and high pass, modern filter design, network transformations and all pass filters. Part C: Measurement & Instrumentation Errors during measurement process, Measurement Noise and Signal Processing, Electrical Indicating and Test Measurement, Variable Conversion Elements, Electrical Transducers, Industrial measurements, Digital Transducers.

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 types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	**63**	**Structured SWL (h/w)**	**4**
Unstructured SWL (h/sem)	**87**	**Unstructured SWL (h/w)**	**6**
Total SWL (h/sem)	**150**		

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	4	20% (20)	3,7,10 and 12	LO #1, #2 and #10, #11
	Assignments	1	10% (10)	11	LO #3, #4 and #6, #7
	Projects / Lab.		10% (10)	Continuous	All
	Report		10% (10)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	1.5hr.	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	Self-Inductance, Coupled Inductor, Mutual Inductance
Week 2	Mutual Inductance between Two Coupled Inductors, Dot Convention, coefficient of coupling, Inductances in series and Parallel
Week 3	Linear Transformer, Ideal Transformer
Week 4	equivalent circuit's linear, ideal transformers, autotransformer
Week 5	Classification of Filters, Characteristic of Filters
Week 6	Constant-k Filter, modern filter design
Week 7	network transformations and all pass filters
Week 8	Mid-term
Week 9	Source of errors and reduction of errors, Sources of measurement noise, techniques for reducing measurement noise, and introduction to signal processing
Week 10	Digital meters (voltage to time conversion type, potentiometric type, dual slope integration type, voltage to frequency type and multi-meters)
Week 11	analog meters (electrodynamic type, clamp-on meters, and thermocouple meter), cathode ray oscilloscope and digital storage oscilloscope
Week 12	Bridge circuits (Wheatstone, deflection type DC bridge and AC bridges), and their applications
Week 13	Resistive, Inductive and Capacitive transducers, measurement of transducer output, modulation and demodulation in transducers.
Week 14	Level measurement, Pressure measurement: Burden tube, Bellows, Diaphragms, Differential pressure measurement, Flow measurement, Temperature measurement, Force, Load cell.
Week 15	Opt couplers and OID, optical detection, magnetic pickups, Speed measurement, Position measurement, Other digital transducers
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. Electric Circuits, James W. Nilsson, Susan A. Riedel, Pearson. 2. Circuit Analysis: Theory and Practice, Allan H. Robbins and Wilhelm C. Miller 3. Modern electronics Instrumentation and measurement techniques by Albert D. Helfrick And William D. Cooper	
Recommended Texts	1. Fundamentals of Electric Circuits, C.K. Alexander and M.N.O Sadiku, McGraw-Hill Education 2. A course in Electrical and electronics measurement and instrumentation by A.K.Sawhney, 2nd Edition by Dhanpatrai	
Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering	

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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>**Module Title**</td><td colspan="3">Electrical Machine II</td><td colspan="2">**Module Delivery**</td></tr>
<tr><td>**Module Type**</td><td colspan="3">**Core**</td><td colspan="2" rowspan="4">☒Theory
☒ Lecture
☒ Lab
☒ Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>**Module Code**</td><td colspan="3">EL222</td></tr>
<tr><td>**ECTS Credits**</td><td colspan="3">6</td></tr>
<tr><td>**SWL (hr/sem)**</td><td colspan="3">150</td></tr>
<tr><td colspan="2">**Module Level**</td><td>2</td><td colspan="2">**Semester of Delivery**</td><td>4</td></tr>
<tr><td colspan="2">**Administering Department**</td><td>Electrical Engineering</td><td>**College**</td><td colspan="2">Engineering</td></tr>
<tr><td>**Module Leader**</td><td colspan="2">Zahraa Dawood</td><td>**e-mail**</td><td colspan="2">zahraadawood12@gmail.com</td></tr>
<tr><td colspan="2">**Module Leader’s Acad. Title**</td><td>Lecturer</td><td colspan="2">**Module Leader’s Qualification**</td><td>M.Sc.</td></tr>
<tr><td>**Module Tutor**</td><td colspan="2">Zahraa Dawood</td><td>**e-mail**</td><td colspan="2">zahraadawood12@gmail.com</td></tr>
<tr><td colspan="2">**Peer Reviewer Name**</td><td></td><td>**e-mail**</td><td colspan="2"></td></tr>
<tr><td colspan="2">**Scientific Committee Approval Date**</td><td>1 / 6 /2023</td><td colspan="2">**Version Number**</td><td>1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>**Prerequisite module**</td><td>Electrical Machine I</td><td>**Semester**</td><td>3</td></tr>
<tr><td>**Co-requisites module**</td><td>None</td><td>**Semester**</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	6. The module aims to introduce students to the fundamental concepts of transformers, including principle working, primary and secondary windings, and core materials. 7. Students will learn about various types of transformers, such as step-up, step-down, auto-transformers, and three-phase transformers. 8. Students will learn to analyze the electrical parameters and ratings of transformers, such as voltage ratios, power ratings, voltage regulation, and efficiency. 9. Students will also learn transformer configurations and connections, such as delta-delta, delta-wye, and wye-wye connections. 10. Additionally, students will understand distribution transformers and calculate all-day efficiency.
Module Learning Outcomes	By the end of this module, students will be able to: 1. Understand the principles and functioning of transformers. This includes basic concepts such as transformer construction, magnetic circuits, electromagnetism, and transformer operation. 2. Comprehend the efficiency aspects associated with power transfer, losses, and voltage regulation. This knowledge is essential for designing and operating efficient electrical systems. 3. Understand different performance parameters, including voltage regulation, impedance, voltage drop, and power factor, helps in interpreting transformer specifications and evaluating their suitability for various applications. 4. Understand and analyze the ideal transformer, practical transformer on load, phasor diagram, and circuit elements for the transformer. 5. Analysis of magnetic leakage and resistance of the winding with an approximate equivalent circuit 6. Calculate regulation, percentage impedance, reactance, resistance, and approximate voltage drop. 7. Understand transformer tests such as open circuit and short circuit tests and calculate the constant parameters and total losses (iron and Cu losses) of the transformer circuit. 8. Analyze and understand the auto-transformer's saving of copper in the autotransformer. 9. Analyze the parallel operation of Single-Phase Transformers and comprehend the conditions for satisfactory parallel operation. 10. Analyze three-phase transformer connections and calculate the kVA rating, transformation ratio, efficiency, regulation, and rating power.
Indicative Contents	Indicative content includes the following (**6 hours per week**) 1. Principle of working of a transformer, E.M.F. Equation, Transformation ratio • Understanding the working principles of electric transformers by applying Faraday's and Lenz's laws and mutual induction • Studying construction and the type of transformer according to construction. • Understanding and applying the E.M.F. equation of the transformer circuit

	2. Ideal transformer, Practical transformer, phasor diagram, transformer on load • Studying the properties of ideal and practical transformers • Understand and analyze the phasor relationships of ideal and practical transformers by visualizing Voltage and Current Relationships. • Calculate the primary current and iron loss for an ideal transformer with no load. • Exploring the Functionality of Transformers on Load. • Analyzing the phasor diagram of a loading transformer at different loads such as resistive, inductive, and capacitive • Calculate and analyze primary current, power factor, and power dissipation. 3. Equivalent circuit, approximate voltage drops, percentage regulation • Studying transformer circuit elements such as leakage reactance and resistance of winding. • Analyze the exact and approximate circuits and calculate the equivalent elements referred to as secondary or primary. • studying the complete phasor diagram at leading, lagging, and unity power factors. • Driving and applying voltage regulation, regulation, per unit impedance, reactance, and resistance. 4. Total Losses, Efficiency • Studying transformer losses, including iron and copper losses • Calculate efficiency at any load and find the condition of maximum efficiency. 5. Transformer Test • Open circuit test • Short circuit test • Sumpner test 6. Auto transformer, Paralleling transformer • Analyzing autotransformers and studying the saving of copper in autotransformers • Understanding parallel transformer configurations and studying the benefits and conditions of parallel connections • Analyzing the equal and unequal voltage ratios of the two paralleling transformers 7. Three-phase transformer • Studying three-phase transformers and banks of three single-phase transformers. • studying the connections of a three-phase transformer and understanding the benefits of each connection. • Calculate losses, voltage drop, regulation, and per-unit impedance per phase.

Learning and Teaching Strategies	
Strategies	8. **Lecture method:** In this traditional strategy, the teacher presents information through verbal communication, supplemented with visual aids or demonstrations. 9. **Active learning:** Encourages student engagement through participation, discussion, and problem-solving activities rather than passive listening. 10. **Flipped classroom:** Students engage with instructional materials outside of class (e.g., watching videos, reading texts) and then use class time for activities, discussions, and personal interaction with the teacher. 11. **Assessments**: Implement regular formative assessments, such as quizzes, assignments, and in-class exercises, to evaluate students' understanding and progress. Provide constructive feedback to guide their learning and address any misconceptions. 12. **Review Sessions**: Before exams or major assessments, conduct review sessions to summarize key concepts, address common challenges, and provide additional practice problems. This helps consolidate knowledge and reinforces understanding 13. **Mid-term Exam**: Administer a mid-term exam to assess students' comprehension of the topics covered in the first half of the module. This exam can help identify areas that require further clarification or reinforcement. 14. **Final Exam**: Conduct a comprehensive final exam to assess students' overall understanding of the module's content. Design the exam to incorporate a variety of question formats, including theoretical concepts, problem-solving, and circuit analysis.

Student Workload (SWL)			
Structured SWL (h/sem)	94	**Structured SWL (h/w)**	6.2
Unstructured SWL (h/sem)	56	**Unstructured SWL (h/w)**	3.8
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 11	LO #2, #4, and #6
	Assignments	3	10% (10)	4,9 and 12	LO #2, #5 and #6
	Projects / Lab.	6	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #1 - #5
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)	
	Material Covered
Week 1	Principle of working of a transformer, Transformer type and construction, transformer action, Faraday's, and Lenz's law's
Week 2	E.M.F. Equation, general equation, voltage ratio, current ratio, power rating equations, volt per turn form general equation volt per turn in terms of power rating.
Week 3	Ideal transformer, Practical transformer on no load, phasor diagram
Week 4	Transformer on load, Phasor Diagram
Week 5	Equivalent circuit of the transformer, leakage reactance, equivalent resistances, reactance's, and impedances phasor diagrams
Week 6	Approximate voltage drops, Percentage regulation, Regulation calculation using voltage values
Week 7	Mid-term Exam
Week 8	Total Losses, Efficiency, losses in transformer, Equations of these losses relating to transformer variables as a function to frequency and voltage (eddy current loss and hysteresis loss)
Week 9	Transformer Test: Open circuit Test, Short circuit Test
Week 10	Regulation calculation using short and open circuit tests, Efficiency calculation using short and open circuit tests, Maximum efficiency
Week 11	All day Efficiency
Week 12	Auto transformers and their types
Week 13	Transformer polarity, Parallel operation of transformers
Week 14	Three-phase transformer
Week 15	Connection of three phase transformers
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Exploring the Essentials of DC Machine Lab
Week 2	No-load Characteristics (O.C.C.) of Separately Excited Dc Generator
Week 3	Study the Conditions for Build-up of a DC Shunt Generator
Week 4	Study of Load Characteristics of DC Shunt Generator
Week 5	Speed Control of Separately Excited Dc Motor
Week 6	Load Characteristics of Long Shunt DC Compound Motor
Week 7	Swinburn's Test

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Electrical Technology, B.L. Theraja, Volume-II (AC & DC Machines)	Yes
Recommended Texts	Principles of Electrical Machines By V. K. Mehta, Rohit Mehta	No

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 works 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

Module Information				
Module Title	Mathematics IV		Module Delivery	
Module Type	Basic		☒Theory ☐Lecture ☐Lab ☒Tutorial ☐Practical ☐Seminar	
Module Code	EE223			
ECTS Credits	4			
SWL (hr/sem)	100			
Module Level	2		Semester of Delivery	4
Administering Department	Elect. Eng. Dept.		College	Engineering
Module Leader	Nabeel Najm Bahlol Al-Mayyahi		e-mail	nabeelclick@uomiasn.edu.iq
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification	M.Sc.
Module Tutor			e-mail	
Peer Reviewer Name			e-mail	
Scientific Committee Approval Date	01/06/2023		Version Number	1.0

Relation with other Modules			
Prerequisite module	EE213	Semester	3
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	This course, Mathematics IV, is specifically designed for undergraduate students in the field of Electrical Engineering. After completing this module, students should have developed a clear understanding of the fundamental concepts of Mathematics and a range of skills allowing them to work effectively with the concepts. The basic concepts are: 5) **First order ODE** such as the topics of Concept of solution, the General and Particular solutions, Initial Value Problem (IVP) and Boundary Value Problem (BVP), Linear and Non-linear ODEs, and the General Solutions of First Order ODEs. 6) **Second and Higher Order ODEs** such as the topics of Homogeneous Linear ODEs of Second Order (Superposition Principles), Initial Value Problem. Basis. General Solution, Homogeneous Linear ODEs with Constant Coefficients, Euler - Cauchy Equations, Differential Operator (D-operator), Methods of Solving Non-homogeneous Linear ODEs, and Solving of higher order linear ODEs with Constant Coefficients. **7)** **Fourier Analysis** such as the topics of Periodic and non- Periodic Functions, Euler Formulas, Even and Odd functions, Half Range Expansion (Fourier Sine and Fourier Cosine), Complex Fourier Series (Exponential), and Applications of Fourier Series in Electric Circuits. **8)** **Sequences and series** such as the topics of Convergence and Divergence Test, Geometric Series and Partial Sum, Integral, Comparison, Ratio and Root Tests, Alternating series, Power Series, Applications of Power Series, and Taylor and Maclaurin Series.
Module Learning Outcomes	After completing this module, students should demonstrate competency in the following skills: 1) Understanding the homogeneous and nonhomogeneous, linear and nonlinear equations. 2) Be able to derive and calculate differential equation. 3) Solving the first, second, and higher order ODEs using different solution of methods. 4) Be able to calculate and derive Bernoulli theorem. 5) Be able to calculate second order differential equation and understand their applications in electronic circuits. 6) Understand the Fourier series and Euler formulas. 7) Be able to determine the sum of certain infinite series, when they exist. 8) Be able to approximate the sum of certain infinite series and analyze the error. 9) To find Geometric, Power, Taylor and Maclaurin series representations for certain functions.

Indicative Contents	**Indicative contents (Course Outlines) include the following: -** **Part A: Differential Equations** **(i) Chapter One First order ODE** i. An introduction to Differential Equations (DEs). ii. Basic Concepts 1. Concept of solution. 2. The General and Particular solutions. 3. Initial Value Problem (IVP) and Boundary Value Problem (BVP). 4. Linear and Non-linear ODEs. iii. The General Solutions of First Order ODEs. 1. Separable ODEs. 2. Equations Reduction to Separable Form. 3. Exact ODEs. 4. Reduction to Exact Form (Integrating Factors). 5. Linear ODEs. 6. Reduction to Linear Form (Bernoulli Equation). **(ii) Chapter Two Second and Higher Order ODEs** i. An introduction to second order ODEs. ii. Homogeneous Linear ODEs of Second Order (Superposition Principles). iii. Initial Value Problem. Basis. General Solution. iv. Homogeneous Linear ODEs with Constant Coefficients. v. Euler - Cauchy Equations. vi. Differential Operator (D-operator). vii. Methods of Solving Non-homogeneous Linear ODEs. 1. Method of Undetermined Coefficients. 2. Method of Variation of Parameters. viii. Solving of higher order linear ODEs with Constant Coefficients. **Part B: Chapter Three Fourier Analysis** i. An introduction of Fourier Series. ii. Periodic and non- Periodic Functions, Euler Formulas. iii. Even and Odd functions. iv. Half Range Expansion (Fourier Sine and Fourier Cosine). v. Complex Fourier Series (Exponential). vi. Applications of Fourier Series in Electric Circuits. **Part C: Chapter Four Sequences and series** i. Convergence and Divergence Test. ii. Geometric Series and Partial Sum. iii. Integral, Comparison. iv. Ratio and Root Tests. v. Alternating series. vi. Power Series.

	vii. Applications of Power Series. viii. Taylor and Maclaurin Series.

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 types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4.2
Unstructured SWL (h/sem)	37	**Unstructured SWL (h/w)**	2.4
Total SWL (h/sem)	**100**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	One hour/ 4	20% (10)	4,8,10, and 14	All
	Assignments	12	20% (10)	2,3,4,6,7,8, 9,10,11,12, 13, and 14	All
Summative assessment	**Midterm Exam**	2 hrs.	10% (10)	8	LO #1 - #7
	Final Exam	3 hrs.	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**Chapter One First order ODE** An introduction to Differential Equations (DEs). Basic Concepts (Concept of solution, The General and Particular solutions, Initial Value Problem (IVP) and Boundary Value Problem (BVP), Linear and Non-linear ODEs)
Week 2	**Chapter One First order ODE** The General Solutions of First Order ODEs (Separable ODEs, Equations Reduction to Separable Form) Assignment No.1
Week 3	**Chapter One First order ODE** The General Solutions of First Order ODEs (Exact ODEs, Reduction to Exact Form (Integrating Factors)). Assignment No.2
Week 4	**Chapter One First order ODE** The General Solutions of First Order ODEs (Linear ODEs, Reduction to Linear Form (Bernoulli Equation)). Assignment No.3 Quiz No.1
Week 5	**Chapter Two Second and Higher Order ODEs** An introduction to second order ODEs. Homogeneous Linear ODEs of Second Order (Superposition Principles). Initial Value Problem. Basis. General Solution.
Week 6	**Chapter Two Second and Higher Order ODEs** Homogeneous Linear ODEs with Constant Coefficients. Euler - Cauchy Equations. Differential Operator (D-operator). Assignment No.4
Week 7	**Chapter Two Second and Higher Order ODEs**

	Methods of Solving Non-homogeneous Linear ODEs. Method of Undetermined Coefficients. Method of Variation of Parameters Assignment No.5
Week 8	**Chapter Two Second and Higher Order ODEs** Solving of higher order linear ODEs with Constant Coefficients Assignment No.6 Quiz No.2 **Midterm Exam**
Week 9	**Chapter Three Fourier Analysis** An introduction of Fourier Series. Periodic and non- Periodic Functions, Euler Formulas. Even and Odd functions. Assignment No.7
Week 10	**Chapter Three Fourier Analysis** Half Range Expansion (Fourier Sine and Fourier Cosine). Complex Fourier Series (Exponential). Applications of Fourier Series in Electric Circuits. Assignment No.8 Quiz No.3
Week 11	**Chapter Four Sequences and series** Convergence and Divergence Test. Geometric Series and Partial Sum. Assignment No.9
Week 12	**Chapter Four Sequences and series** Integral, Comparison. Ratio and Root Tests. Assignment No.10
Week 13	**Chapter Four Sequences and series**

	Alternating series. Power Series. Applications of Power Series. Assignment No.11
Week 14	**Chapter Four Sequences and series** Taylor and Maclaurin Series. Assignment No.12 Quiz No.4
Week 15	**Chapter Four Sequences and series** Revision Week
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Kreyszig, E. (2010). *Advanced engineering mathematics*. John Wiley & Sons.	Yes
Recommended Texts	Thomas, G. B., Weir, M. D., Hass, J., Heil, C., & Behn, A. (2016). *Thomas' Calculus Early Transcendentals*. Pearson.	Yes
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

Module Information					
Module Title	**Electronic Circuit II**		**Module Delivery**		
Module Type	C		☒Theory ☐Lecture ☒ Lab ☒ Tutorial ☐ Practical ☐ Seminar		
Module Code	EL224				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	2		**Semester of Delivery**	4	
Administering Department	Electrical Dep.		**College**	Engineering	
Module Leader	Maab alaa hussein		**e-mail**	maab-alaa @uomisan.edu.iq	
Module Leader's Acad. Title	Lecture		**Module Leader's Qualification**	M.Sc	
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules			
Prerequisite module	Electronic Circuit I	**Semester**	3
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	***The goal of this course is to establish a background on:*** - Frequency Response of BJT single stage and Multistage amplifiers. - Be able to know the effect of internal and external capacitance of an amplifier on the value of voltage gain and phase shift. - The course also aims know how to calculate the values of upper and lower frequencies for single stage and multistage amplifiers.. - In this course we define what is the feedback amplifiers and their types. - Power amplifiers are explained in many types.
Module Learning Outcomes	- Observe the amplitude and frequency responses of common amplification circuits. - Explain the characteristics and operation of low frequency and high frequency for analogue electronic circuits. - Design low and high frequency analogue electronic circuits using electronic mathematical models. - Students analyze and test different active circuits express the basic structure, properties and working principles of feedback circuit. - Design and analyze oscillator electronic circuits using electronic mathematical models. - Design and analyze power amplifier electronic circuits using electronic mathematical models.
Indicative Contents	***Indicative content includes the following.*** ***<u>Part A – Frequency response</u>*** Explain the various modes(classes) of operation used in amplifiers; Calculate the Gain of amplifiers(single and multistage) using the appropriate equivalent circuits; Define bandwidth and sketch typical signal frequency curves (gain db. Against logarithmic frequency); Describe the characteristics and operation of a range of operational amplifiers incorporating resistor capacitor networks (types: integrator, ac coupled amplifier having a high pass frequency response); Calculate the mid band voltage gains and bandwidths of high-pass and low-pass operation amplifier circuits given typical component values. ***<u>Part B – Feedback Amplifier</u>*** There are two basic types of feedback in amplifiers positive feedback and negative Feedback When the feedback energy (voltage or current) is in phase with the input signal and thus aids it, it is called positive feedback. While negative feedback results in reduced overall voltage gain, a number of improvements are obtained, among them being: 1. Higher input impedance. 2. Lower output impedance. 3. Better stabilized voltage gain.4. Improved frequency response.5. Reduced noise. 6. More linear operation. ***<u>Part E – Power Amplifier</u>*** Power amplifiers are generally classified into five types: A, B, AB, and C for analog designs and class D for switching designs. This classification is based on the percentage of the input cycle for which the amplifier operates in its linear region.

Learning and Teaching Strategies	
Strategies	Type something like: 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.

Student Workload (SWL)			
Structured SWL (h/sem)	79	**Structured SWL (h/w)**	5
Unstructured SWL (h/sem)	46	**Unstructured SWL (h/w)**	5
Total SWL (h/sem)	**125**		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction of Frequency Response in single stage amplifier
Week 2	Low Frequency Response
Week 3	Low Frequency Response
Week 4	Low Frequency Response
Week 5	High Frequency Response
Week 6	High Frequency Response
Week 7	High Frequency Response
Week 8	Frequency Response in multistage amplifier
Week 9	Frequency Response in multistage amplifier
Week 10	Frequency Response in multistage amplifier
Week 11	Introduction of Feedback Amplifiers
Week 12	Feedback Amplifiers (type1 and type 2)
Week 13	Feedback Amplifiers (type3 and type 4)
Week 14	Power amplifiers
Week 15	Power amplifiers
Week 16	Preparatory week before the final Exam

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Introduction
Week 2	Test a transistor (short) between terminals
Week 3	Test a transistor (open) between terminals
Week 4	ICBO/ICEO Test on a Test Transistor .
Week 5	DC gain (HFE) of a Transistor
Week 6	Input characteristics of BJT transistor
Week 7	Transistor as switch

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 9th Edition, Pearson Education / PHI, 2007.	*yes*
Recommended Texts	1.Millman J and Halkias .C., Integrated Electronics, TMH, 2007. 2. S. Salivahanan, N. Suresh Kumar and A. Vallavaraj, Electronic Devices and Circuits, 2 nd Edition, TMH, 2007. 29 3.David A. Bell, Electronic Devices & Circuits, 4th Ediion, PHI, 2007	*yes*
Websites	https://www.coursera.org/browse/physical-science-and-engineering/electrical-engineering	

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

Module Information				
Module Title	Electromagnetic Fields		**Module Delivery**	
Module Type	B		☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☐ Seminar	
Module Code	EL225			
ECTS Credits	4			
SWL (hr/sem)	100			
Module Level	2		**Semester of Delivery**	4
Administering Department	Electrical Dep.		**College**	Engineering
Module Leader	Ahmad H. Abood		**e-mail**	prof.dr.ahmad@uomisan.edu.iq
Module Leader's Acad. Title	Professor		**Module Leader's Qualification**	Ph. D.
Module Tutor	Non		**e-mail**	E-mail
Peer Reviewer Name	Non		**e-mail**	E-mail
Scientific Committee Approval Date			**Version Number**	1.0

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Aims	1) To understand the concepts of Electrostatics and their applications. 2) To apply vector calculus to understand the behavior of static electric fields in standard configurations. 3) To use their ability to manage the electromagnetic laws to, in simple situations, set up a computational model and perform the necessary calculations: select appropriate methods; make appropriate approximations; plausibility assesses the results. 4) To analyze how energy is stored and transported in an electrostatics field. 5) To understand the effect of materials on electric and magnetic fields. 6) Use their conceptual understanding of the electromagnetic laws in order to qualitatively describe the behavior of the solution to the problem. 7) Use their ability to manage the electromagnetic laws to, in simple situations, set up a computational model and perform the necessary calculations: select appropriate methods; make appropriate approximations; plausibility assess the results analyze how energy is stored and transported in an electromagnetic field. 8) Describe and analyze electromagnetic wave propagation in free-space. 9) To understand principles of propagation of uniform plane waves.
Module Learning Outcomes	1) Describe and understand the principle of the electrostatic fields, Coulomb's Law and Electrical Field Intensity. 2) Discuss the application of Gauss's Law and Maxwell's First Equation. 3) Recognize the Potential Difference and Potential. 4) Explain Electrostatic in Material Space, Current, Current Density and Conductors. 5) Identify the Laplace's Equations and their applications. 6) To identify the concepts of Magnetostatics and their applications. 7) To explain the concepts of Electromagnetic Fields, waves and wave a. propagation. 8) To understand the relations between the fields under time varying situations. 9) Describe and understand the principle of Ampere's circuit Law-Maxwell's Equation 10) Identify Magnetic Forces, Materials, and Devices 11) An ability to distinguish, identify, define, formulate, and solve Magnetic Scalar and Vector Potentials, Derivation of Boit-Savart's Law and Ampere's Law
Indicative Contents	**Columb's law, Electric field, Electric Flux, Gauss' law, Electric potential, Electric work, Divergence theorem, Conductors, Dielectric, Semiconductor, Capacitance, Poisson's and Laplace Equations, Biot- Savart law, Ampere law, Electric current, Maxwell's equations, Scalar and vector potentials, Magnetic materials**

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 types of simple class works involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4.2
Unstructured SWL (h/sem)	37	**Unstructured SWL (h/w)**	2.47
Total SWL (h/sem)	100		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	5(10%)	Suddenly	2-11
	Assignments	2	5(10%)		6
	Projects / Lab.	-	10%		
	Report	-	10%		
Summative assessment	**Midterm Exam**		(10%)	12	1-5
	Final Exam		(50%)	16	1-11
Total assessment			(100%)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Columb law and electric field
Week 2	Columb law and electric field
Week 3	Columb law and electric field
Week 4	Electric flux, Gauss law and divergence
Week 5	Electric flux, Gauss law and divergence
Week 6	Electric flux, Gauss law and divergence
Week 7	Energy and Potential
Week 8	Energy and Potential
Week 9	Conductors, Dielectrics and Capacitance
Week 10	Conductors, Dielectrics and Capacitance
Week 11	Posson's and Laplace equations
Week 12	Posson's and Laplace equations
Week 13	Steady Magnetic Field
Week 14	Steady Magnetic Field
Week 15	Steady Magnetic Field
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- Mathihew N. O. Sadiku, "Elements of Electromagnetics" , 6th Edition, OXFORD UNIVERSITY PRESS, 2015. 2- William H. Hayt, Jr. . John A. Buck," Engineering Electromagnetics", 6th Edition, The McGraw Companies, 2001. 3- Joseph A. Edminister, Mahmood Nahvi, " Electromagnetics", 4th Edition, McGraw-Hill Education, 2014.	Online
Recommended Texts	1- Mathihew N. O. Sadiku, "Elements of Electromagnetics" , 6th Edition, OXFORD UNIVERSITY PRESS, 2015. 2- William H. Hayt, Jr. . John A. Buck," Engineering Electromagnetics", 6th Edition, The McGraw Companies, 2001.	Online
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

Module Information					
Module Title	Digital Technical II			**Module Delivery**	
Module Type	Core			☒Theory ☐Lecture ☒ Lab ☒Tutorial ☐Practical ☐Seminar	
Module Code	EL226				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	2			**Semester of Delivery**	Four
Administering Department	Electrical Dep.			**College**	Engineering
Module Leader	Dr. Haider Khalaf Allamy			**e-mail**	Haider.allamy@uomisan.edu.iq
Module Leader's Acad. Title	Lecturer			**Module Leader's Qualification**	Ph.D.
Module Tutor				**e-mail**	
Peer Reviewer Name				**e-mail**	
Scientific Committee Approval Date	01/06/2023			**Version Number**	1.0

Relation with other Modules			
Prerequisite module	EL216	**Semester**	Three
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. To establish the basic concepts of Digital Combinational Circuits Design. 2. To understand the basic Arithmetic and digital circuits. 3. To perform Logical and digital Circuits analysis. 4. To develop problem solving skills and understanding of Digital Systems through the application of techniques. 5. To establish the basic design concepts of Digital Sequence machines and counters. 6. To understand the Basic digital memory circuits and types. 7. To perform Logical and digital sequential circuits analysis. 8. To introduce the Basic Digital circuits operation and analysis
Module Learning Outcomes	1) To outline the formal procedures for the analysis and design of combinational circuits. 2) Students should be able to explain about digital systems and logic circuits. 3) The students should be able to differentiate between combinational and sequential circuits through understanding the clocking and synchronization. 4) To introduce Latches and Flip-flops Design as Simple Sequential Circuits Examples 5) To introduce the Basics of Digital Counters Analysis and Design as a sequential machine. 6) To Learn the design and analysis of Shift registers with various types 7) To outline the Basic Digital memory Circuits, types, operation, capacity and organization.
Indicative Contents	Indicative content includes the following. **COMBINATIONAL CIRCUITS: 12 Hours** Adders Arithmetic Operations: Subtractions, half and full adders and subtractions, binary parallel address. Code Conversion: Even and odd party logic, decoders, encoders, comparators, multiplexers and DE multiplexers. Sequential logic circuits: **12 Hours** Latches: SR latch, Gated SR Latch, D-latch, D-latch with enable Flip- flops: latches flip- flops, R-S and J-K flip, Master Slave flip flop, J-K flip flop, T and D flip flop Counters: **12 Hours** Mode N Counters, ripple counters, synchronous counters, ring/Johnson counters. Asynchronous counters- Mod-N or divided by N Counter. Shift registers: **4 Hours** Basic principle, serial and parallel data transfer, shift left/right registers, universal shift register. Shift Registers. Memory design: **5 Hours** Classification of memories, ROM, ROM organization, PROM, EPROM, EEPROM, EAPROM, RAM, RAM organization, Write operation, Read operation, Memory cycle, Timing wave forms, Memory decoding, memory expansion.

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 types of simple experiments involving some sampling activities that are interesting to the students. Team work skills are trained through teaching groups Quiz.

Student Workload (SWL)			
Structured SWL (h/sem)	79	**Structured SWL (h/w)**	5.2
Unstructured SWL (h/sem)	46	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	**125**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	3	10% (10)	3, 5 and 10	LO #1, #4 and #3
	Assignments	2	10% (10)	2 and 12	LO #1 and #6
	Projects / Lab.	1	10% (10)	Continuous	All
	Report	1	10% (10)	13	LO #6, #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	**COMBINATIONAL CIRCUITS: 12 Hours** Adders Arithmetic Operations: half and full adders
Week 2	Subtractions, Subtractions and binary parallel address.
Week 3	Code Conversion: Even and odd party logic, decoders, encoders
Week 4	Comparators, multiplexers and DE multiplexers.
Week 5	Sequential logic circuits: **12 Hours** Latches: SR latch, Gated SR Latch, D-latch,
Week 6	D-latch with enable Flip- flops: latches
Week 7	Mid-term + Flip- flops, R-S and J-K flip flop
Week 8	Master Slave flip flop, J-K flip flop, T and D flip flop
Week 9	Counters: **12 Hours** Mode N Counters, ripple counters
Week 10	synchronous counters, ring/Johnson counters
Week 11	Asynchronous counters Mod-N or divided by N Counter
Week 12	Shift registers: **4 Hours** Basic principle, serial and parallel data transfer.
Week 13	Shift left/right registers, universal shift register. Shift Registers.
Week 14	Memory design: **5 Hours** Classification of memories, ROM, ROM organization, PROM, EPROM, EEPROM, EAPROM, RAM, RAM
Week 15	Organization, Write operation, Read operation, Memory cycle, Timing wave forms, Memory decoding, memory expansion.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	LAB1: Design and implementation of Adder and Subtractor using logic gates.
Week 2	Design and implementation of 4 bit binary Adder/ Subtractor and BCD adder.
Week 3	Design and implementation of 2 bit Magnitude Comparator using logic gates 8 Bit Magnitude Comparator.
Week 4	Design and implementation of 16 bit odd/even parity checker generator.
Week 5	Design and implementation of Multiplexer and De-multiplexer using logic gates
Week 6	Design and implementation of encoder and decoder using logic gates
Week 7	Realization of RS-JK & D flip-flops using Universal logic gates.

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Thomas L. Floyd, Digital Fundamentals, 8th Edition, Pearson Education Inc, New Delhi, 2003	yes
Recommended Texts	M. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.	yes
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

Module Information					
Module Title	Electrical machines III			Module Delivery	
Module Type	Core			☒Theory ☐ Lecture ☒Lab ☒Tutorial ☐Practical ☐Seminar	
Module Code	EL311				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	3		Semester of Delivery		5
Administering Department	Electrical Dep.		College	Engineering	
Module Leader	Mohammed H. Lazim		e-mail	Mohammed.hasan@uomisan.edu.iq	
Module Leader's Acad. Title	Lecturer		Module Leader's Qualification		M.Sc.
Module Tutor	Mohammed H. Lazim		e-mail	Mohammed.hasan@uomisan.edu.iq	
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date	01/06/2023		Version Number	1.0	

Relation with other Modules			
Prerequisite module	Electrical machines I& II, Electrical Circuit I& II, Fundamental of EE I &II.	Semester	1,2,3,4
Co-requisites module	None	Semester	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	Generally, the aims of this module are to give the students adequate knowledge about induction machines, particularly in the study of induction machines (1 phase induction motor,3 phase induction motor, and induction generators), enabling them to understand their principles, analyze their performance and apply this knowledge in practical applications in various industries. Objectives can be described in detail in the following points: 1. Understanding the basic principles of induction machines: Students should be able to digest the fundamental concepts and principles behind the operation of n, including electromagnetism, magnetic fields, and the interaction between stator and rotor. 2. Describe the construction of induction machines: Students should be able to describe the constructional features and the equivalent circuit of different types of Induction machines, such as 3 phase induction motor, 1 phase induction motor and induction generator. 3. Analyze the performance characteristics of Induction machines: Students should be able to analyze and interpret the performance characteristics of induction machines, including torque-speed characteristics, starting, braking, and speed control of motors. also, students should have the ability to use the circle diagram tool and phasor diagrams. 4. Calculate and design Induction machine parameters: Students should be able to calculate and design various parameters of induction machines, such as the parameters of the equivalent circuit -the resistances and reactance of stator and rotor- from no load test and blocked rotor test, winding arrangements, number of poles, magnetic flux, and electromagnetic forces. power factor and efficiency. 5. Understand the speed control techniques of induction machines: Students should have a solid understanding of the operation and control methods for induction machines, including concept of slip, rotor resistance control, voltage control, and the principle of Ac drives like VFD. 6. Analyse and troubleshoot Induction machine faults: Students should be able to analyze and troubleshoot common faults and problems that can occur in Induction machines, such as unbalanced voltages, rotor faults, stator faults, and bearing failures. 7. Apply knowledge in practical applications: Students should be able to apply their knowledge of Induction machines to practical applications, such as motor selection, sizing, and protection. 8. Develop laboratory skills: Students should develop practical skills in conducting experiments and practical exercises related to Induction machines, including performance testing, efficiency measurement, and fault diagnosis. 9. Communicate effectively: Students should be able to effectively communicate their ideas and findings related to Induction machines, both in written reports and oral presentations.
Module Learning Outcomes	The module learning outcomes of studying the induction machines in the third year of undergraduate study: 69. To understand the basic principles of induction machines. This includes understanding the physical construction of induction machines (poly phase induction motors, single phase induction motors and induction generators), recognize the rotating magnetic field theory, also the types of these machines. 70. To determine the electrical parameters of the equivalent circuit of the induction machines. Including calculation the resistances and reactance of stator and rotor from no load test and bloked rotor test. 71. To calculate the losses, power factor, losses, output power and torque from the parameters of the equivalent circuit. 72. To learn the speed torque characteristics of induction machines and explain how to maximize the starting torque or how to gain maximum torque. 73. To learn the starting methods of poly phase induction motor like star-delta, soft starting and direct on-line methods and to identify the appropriate method to start the induction motors. 74. To know the possible techniques to control the speed of induction motors and the application of each technique. 75. To learn the methods to control the speed of induction motors such as the variable

	resistor method, variable voltage method and the recent methods such as variable frequency drive VFD. Also, to identify the appropriate method in industrial applications. 76. To know the methods to break the induction machines: such as plugging and regenerative method. And the application of each method. 77. To learn the induction generators: including the construction, working principle, types, speed-power characteristics connection and the applications. 78. To learn the various types of 1 phase induction motor and their advantages and disadvantages and the appropriate application of each one. 79. To analyze the methods of revolving field theory of 1 phase induction motor, like double revolving field theory and symmetrical components analysis, as well as to learn the characteristics and windings of single-phase IM. 80. Finally, understanding the circle diagram, make the students be able to knowledge an overview about 1 phase induction motor, including designing , operating and calculation the desired parameters at any operating point.
Indicative Contents	Indicative content includes the following. • Induction Motors Salient constructional features of squirrel cage and slip ring 3-phase induction motors, Principle of operation, slip and its significance and connection, Locking of rotor and stator fields, Rotor resistance, inductance, emf and current, Relationship between copper loss and the motor slip, Power flow diagram of an induction motor, Factors determining the torque, Torque-slip curve, stable and unstable zones. Effect of rotor resistance upon the torque slip relationship, starting of 3-phase induction motors, DOL, star-delta, auto transformer, Causes of low power factor of induction motors, Testing of 3- phase motor on no load rotor test and find efficiency, Speed control of induction motor, conventional and thyristorized. • Polyphase induction motors. Basic theory and construction of squirrel-cage and wound-rotor motors; equivalent circuit; measurement of equivalent circuit parameters; analysis of machine equations; speed/torque curves; circle diagram; starting performance; speed control; single-phase induction motor; deep bar effect in squirrel-cage induction motor. • Single-phase ac motors. Outline of shaded-pole, universal, and reluctance machines with applications. Single phase induction motors; Construction characteristics and applications, Split phase induction motor, Capacitors start and run motor, Shaded pole motor, Reluctance start motor, Alternating current series motor and universal motors and Reluctance motor.

Learning and Teaching Strategies	
Strategies	1. The following strategies can be used to help the students to digest the information simply: 2. Interactive lectures :Using multimedia in the classes like animated video about the working principles of electrical machines enhances the imagination of the students. Also engaging students in group discussions promotes active learning and encourages peer-to-peer interaction. 3. Choosing the interactive tutorials and examples of real numbers from the laboratory or familiar in the industry 4. Using the laboratories as an approach to link the theoretical aspect with reality and simplify understanding of the curriculum with interactive experiments. 5. Practical activities: Assigning interesting practical activities to develop students' creativity.

	6. Computer Simulations: Utilizing computer simulations and software tools can provide a virtual environment for students to experiment with Induction machines. Simulations can help students visualize complex concepts and observe the impact of different parameters on machine performance. 7. Case Studies: Presenting real-life case studies or industry examples can help students understand how induction machines are used in practical applications. This can enhance their problem-solving skills and critical thinking abilities. 8. Assessments: Conduct regular assessments, quizzes, and examinations to gauge students' understanding and monitor their progress. This provides feedback and identifies areas where additional support or clarification may be required.

Student Workload (SWL)			
Structured SWL (h/sem)	94	**Structured SWL (h/w)**	6.266
Unstructured SWL (h/sem)	56	**Unstructured SWL (h/w)**	3.733
Total SWL (h/sem)	**150**		

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.	7	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	3 hr.	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Construction and principal operation of 3-Phase Induction Motors, production of rotating magnetic field
Week 2	Equivalent circuit of 3-Phase Induction Motors, No-load test, and blocked rotor test.
Week 3	Power stages, efficiency, and losses of 3 phase induction motor
Week 4	Torque-speed characteristics, starting and maximum torque

Week 5	Starting of 3-phase induction motor: Variable resistance in stator, auto-transformer method, star-delta method, and soft starting methods.
Week 6	Speed control of 3-phase induction motor, braking of 3-phase induction motor
Week 7	Induction generator. Working principle, construction,
Week 8	Types of induction generator, applications, characteristics of slip-torque and the output power
Week 9	Single phase induction motors: Construction and working principle,
Week 10	Production of rotating magnetic field, double field theory, symmetrical theory.
Week 11	Torque speed characteristics, starting methods of 1 phase induction motor
Week 12	Types of single-phase induction motor, Application of 1 phase induction motor
Week 13	General equivalent circuit, no-load test, and blocked rotor test, phasor diagram of 1 phase induction motor
Week 14	Power stages, losses, separation the mechanical and iron losses, and efficiency
Week 15	Speed control of 1 phase induction motor, circle diagram of 1 phase induction motor
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Name plate, classifications of insulations, Polarity test of stator windings, Connections of stator windings, Running and reversing the direction of rotation of 3 phase induction motor
Week 2	Starting of 3 phase induction motor, soft starting, Autotransformer, and star delta test
Week 3	speed control of 3 phase induction motor voltage control method, VFD method
Week 4	Single phase induction motors: starting, running, and reversing
Week 5	No load and blocked rotor test and finding the efficiency of 1 phase induction motor
Week 6	Torque-slip test of 1 phase induction motor.
Week 7	Induction generator, working principle, characteristics of speed-power.

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Theraja BL Theraja AK. *A Textbook of Electrical Technology*. New Delhi India: S. Chand;	Yes
Recommended Texts	2. Principles of electrical machines V.K. Mehta, Rohit Mehta, Pub, S. Chand, India	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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>**Module Title**</td><td colspan="3">Power System I</td><td colspan="2">**Module Delivery**</td></tr>
<tr><td>**Module Type**</td><td colspan="3">C</td><td colspan="2" rowspan="4">☒Theory
☐Lecture
☐Lab
☐Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>**Module Code**</td><td colspan="3">EL312</td></tr>
<tr><td>**ECTS Credits**</td><td colspan="3">5</td></tr>
<tr><td>**SWL (hr/sem)**</td><td colspan="3">125</td></tr>
<tr><td colspan="2">**Module Level**</td><td>3</td><td colspan="2">**Semester of Delivery**</td><td>5</td></tr>
<tr><td colspan="2">**Administering Department**</td><td>Electrical Dep</td><td>**College**</td><td colspan="2">Engineering</td></tr>
<tr><td>**Module Leader**</td><td colspan="2">Name</td><td>**e-mail**</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">**Module Leader's Acad. Title**</td><td>Professor</td><td colspan="2">**Module Leader's Qualification**</td><td>Ph.D.</td></tr>
<tr><td>**Module Tutor**</td><td colspan="2">Name (if available)</td><td>**e-mail**</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">**Peer Reviewer Name**</td><td>Name</td><td>**e-mail**</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">**Scientific Committee Approval Date**</td><td>01/06/2023</td><td>**Version Number**</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>**Prerequisite module**</td><td>None</td><td>**Semester**</td><td></td></tr>
<tr><td>**Co-requisites module**</td><td>None</td><td>**Semester**</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	77. To understand the importance of Electrical Power Systems. 78. To understand the principal work of Electrical Power Systems. 79. To understand the parameters of Electrical Power systems. 80. To enhance the performance of Electrical Power Systems. 81. To develop the skills required to develop the Electrical Power Systems. 82. To analysis of the high voltage of power transmission line
Module Learning Outcomes	81. Recognize how is working power generating plants 82. List the parameters of hight voltage transmission line 83. Analysis the issues of Sag which happens in power transmission line 84. Discuss the Mechanical Design of Transmission Line 85. Describe the Electrical Characteristics of Overhead Transmission Line 86. Define Corona.
Indicative Contents	Indicative content includes the following. **Sources of Electrical Energy** Structure of power system and its elements, major sources of primary energy, power stations, steam, hydro, gas turbines, nuclear, M.H.D generation, renewable energy sources, solar energy, wind generators, other renewable sources, AC and DC single and 3-phase transmission, development of electric power in Iraq. [25 hrs] **Economical Aspects of Power Systems** Economics of generation, load curves, choice of size and number of generator units, effect of system voltage on transmission efficiency of power supply system, choice of transmission voltage, conductor size and Kelvin's law, power factor improvement, most economical power factor, tariffs. [25 hrs] **Mechanical Design of Transmission Lines** Conductor materials, line supports, sag, calculation of sag, effect of wind and ice, insulators, voltage distribution over an insulator string, string efficiency, improving string efficiency. [30 hrs] **Corona** Phenomenon, disruptive critical voltage, visual critical voltage, corona losses, factor and conditions affecting corona losses. [15 hrs] **Underground Cables** Conductor materials, insulating materials, sheathing end armoring materials, types of cables, insulation resistance, stress and capacitance, use of inter sheaths, capacitance grading, power factor in cables, capacitance in three core cables, thermal characteristics, comparison between overhead lines and underground cables. [30 hrs]

Learning and Teaching Strategies	
Strategies	Type something like: 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.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4.2
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**		10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments		10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.		10% (10)	Continuous	All
	Report		10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**		10% (10)	7	LO #1 - #7
	Final Exam		50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Structure of power system and its elements, major sources of primary energy,
Week 2	power stations, steam, hydro, gas turbines, nuclear, M.H.D generation
Week 3	renewable energy sources, solar energy, wind generators, other renewable sources
Week 4	AC and DC single and 3-phase transmission, development of electric power in Iraq
Week 5	Economics of generation, load curves, choice of size and number of generator units
Week 6	effect of system voltage on transmission efficiency of power supply system
Week 7	Mid-term + choice of transmission voltage, power factor improvement, most economical power factor
Week 8	Conductor materials, line supports, sag,
Week 9	calculation of sag, effect of wind and ice,
Week 10	insulators, voltage distribution over an insulator string,
Week 11	string efficiency, improving string efficiency
Week 12	Phenomenon, disruptive critical voltage, visual critical voltage, corona losses, factor and conditions affecting corona losses.
Week 13	Conductor materials, insulating materials, sheathing end armoring materials, types of cables
Week 14	insulation resistance, stress and capacitance, use of inter sheaths, capacitance grading, power factor in cables.
Week 15	capacitance in three core cables, thermal characteristics, comparison between overhead lines and underground cables
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	ESSENTIAL READING 1. V. K. Mehta and Rohit, "**Principles of Power System**", S. Chand, 2005	
Recommended Texts	RECOMMENDED READING 1. Stevenson, W. D. (1994). **Power Systems: Analysis and Design**. McGraw-Hill. 2. Hadi Saadat, "**Power System Analysis**", Tata McGraw-Hill, 2002. 3. T. K. Nagsarkar, "**Power System Analysis**", Oxford University Press, 2014.	
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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Communication I</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">Core</td><td colspan="2" rowspan="4">☒Theory
☐Lecture
☐Lab
☒Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">EL313</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">125</td></tr>
<tr><td>Module Level</td><td>3</td><td colspan="2">Semester of Delivery</td><td colspan="2">five</td></tr>
<tr><td>Administering Department</td><td>Electrical Dep.</td><td>College</td><td colspan="3">Engineering</td></tr>
<tr><td>Module Leader</td><td>Name</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Professor</td><td colspan="2">Module Leader’s Qualification</td><td colspan="2">Ph.D.</td></tr>
<tr><td>Module Tutor</td><td>Name (if available)</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Peer Reviewer Name</td><td>Name</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Scientific Committee Approval Date</td><td>01/06/2023</td><td colspan="2">Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	83. To understand the fundamental concepts and principles of signal analysis. 84. To understand signal and system classifications 85. To analyze and design various analog modulation techniques such as amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM). 86. To comprehend the characteristics of different analog communication channels and their impact on system performance. 87. To explore the concept of noise in analog communication systems and its effects on signal quality. 88. To learn about various techniques for improving signal-to-noise ratio
Module Learning Outcomes	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 87. Identify signal analysis techniques using Fourier series and Fourier transform 88. Discuss the communication system components. 89. Summarize what is meant by modulation and why modulation. 90. Explain various types of analog modulation such as amplitude modulation (AM), frequency modulation (FM), and phase modulation (PM). 91. Describe the process of modulation and demodulation of various types of analog modulation using circuits and blocks. 92. Evaluate the performance of analog communication systems using metrics such as signal to noise ratio (SNR) and bandwidth efficiency.
Indicative Contents	**Communication system elements (signal analysis)** Signal classification of periodic and non-periodic signal, Fourier series and Fourier transform, Classification of system ,power spectral density, correlations[15hr] **Noise:** Types, power calculation, thermal white Gaussian noise (AWGN), BAND-LIMITED noise(base band and band pass), Noise through linear systems.[15 hr] **Linear modulation** AM/DSB-LC, AM/DSB-SC, AM/SSB-SC, AM/VSB, Noise in AM System, Frequency division multiplexing (FDM), commercial receivers(TRF and super-heterodyne), and noise in AM systems.[15 hr] **Angle Modulation** NBFM, NBPM, WBPM, Noise in angle modulation systems.[15 hr]

Learning and Teaching Strategies	
Strategies	This module will be delivered by class lectures which provide well knowledge about module contents and encourage student to solve assignments through interactive tutorials. Visual teaching will be considered to create metal image or diagrams to help understanding the concepts of contents.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	62	**Unstructured SWL (h/w)**	4
Total SWL (h/sem)	**125**		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Signal classification of periodic and non-periodic signal
Week 2	Fourier series and Fourier transform
Week 3	Classification of system ,power spectral density, correlations
Week 4	**Noise:** Types, power calculation, thermal white Gaussian noise (AWGN)
Week 5	BAND-LIMITED noise (base band and band pass) , Noise through linear systems
Week 6	AM/DSB-LC, AM/DSB-SC,
Week 7	AM/SSB-SC, AM/VSB, Noise in AM System
Week 8	Midterm exam
Week 9	Modulation and demodulation of various types of AM
Week 10	Angle modulation :Frequency modulation (FM)
Week 11	NBFM, NBPM, WBPM
Week 12	Modulation and demodulation of FM
Week 13	Phase modulation (PM)
Week 14	Modulation and demodulation of PM
Week 15	Noise in angle modulation
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Communication systems –simon haykins	Available
Recommended Texts	Communication systems –by A B Carson	
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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="2">Engineering Analysis</td><td colspan="3">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="2">Core</td><td colspan="3" rowspan="4">☒Theory
☐Lecture
☐Lab
☒Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="2">EL314</td></tr>
<tr><td>ECTS Credits</td><td colspan="2">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="2">125</td></tr>
<tr><td>Module Level</td><td colspan="2">3</td><td colspan="2">Semester of Delivery</td><td>5</td></tr>
<tr><td>Administering Department</td><td colspan="2">Electrical Dep.</td><td>College</td><td colspan="2">Engineering</td></tr>
<tr><td>Module Leader</td><td colspan="2">Name</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td colspan="2">Professor</td><td colspan="2">Module Leader’s Qualification</td><td>Ph.D.</td></tr>
<tr><td>Module Tutor</td><td colspan="2">Name (if available)</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td>Peer Reviewer Name</td><td colspan="2">Name</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td>Scientific Committee Approval Date</td><td colspan="2">01/06/2023</td><td colspan="2">Version Number</td><td>1.0</td></tr>
</table>

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

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	89. 1. Understand the principles and techniques of engineering analysis. 90. 2. Develop skills in applying mathematical and computational methods to solve engineering problems. 91. To develop problem solving skills and understanding of Fourier series and Fourier transform. 92. To understand Z-Transform. 93. Learn how to analyze complex variable problems. 94. Develop a strong foundation for solution of Differential Equations using power series.
Module Learning Outcomes	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 93. Recognize frequency domain analysis using Fourier transform. 94. Applying Z-Transform and inverse Z-Transform. 95. Analysis discrete-time systems, applications. 96. Discuss the function of complex variable and analytic function. 97. Evaluate Mapping and integration in the complex plane 98. Perform the Solution of Differential Equations using power series
Indicative Contents	Indicative content includes the following. **<u>Fourier series and Fourier Transform</u>** Introduction, periodic functions properties, sine and cosine form, half range series, complex Fourier series, Parseval's theorem. Fourier integral ,Fourier transform Properties, convolution theorem, power spectral, density and correlations, signals and linear systems, applications [15 hrs] **<u>The Z-Transform</u>** Region of convergence, properties of Z-transforms, Z-transform pairs, the inverse of Z transform, analysis and discrete-time systems, applications.[10 hrs] **<u>Complex Variable Theory</u>** Functions of complex variables, complex differentiation, analytic functions and its properties, integration in the complex plane, Cauchy’s theorem, Cauchy’s integral formula for simply and multiply connected regions, Taylor’s and Laurent series, the residue theorem. [15 hrs] **<u>Solution of Differential Equations using power series</u>** Legendre’s equation, Legendre’s polynomials, Bessel functions of the first and second orders, Bessel function properties. [10 hrs] **<u>Partial Differential Equations</u>** Wave equation, Laplace equation, solution of boundary condition problems, general solution, solution by separation of variables. [10hrs]

Learning and Teaching Strategies	
Strategies	This module will be delivered through class lectures and tutorials where student will be able to understand the module content. Active learning will be implemented via collaborative group to solve exercise, assignments and projects.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	62	**Unstructured SWL (h/w)**	4
Total SWL (h/sem)	**125**		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction, periodic functions properties, sine and cosine form
Week 2	half range series, complex Fourier series
Week 3	Parseval's theorem, Fourier integral, Fourier transform Properties
Week 4	convolution theorem, power spectral, density and correlations ,signals and linear systems, applications
Week 5	Region of convergence, properties of Z-transforms
Week 6	Z-transform pairs, the inverse of Z transform
Week 7	Analysis of discrete-time systems, Z-transform applications.
Week 8	Midterm exam and Related rates
Week 9	Functions of complex variables, complex differentiation
Week 10	analytic functions and its properties, integration in the complex plane
Week 11	Cauchy's theorem, Cauchy's integral formula for simply and multiply connected regions
Week 12	Taylor's and Laurent series, the residue theorem
Week 13	Legendre's equation, Legendre's polynomials,
Week 14	Bessel functions of the first and second orders, Bessel function properties.
Week 15	Wave equation, Laplace equation, solution of boundary condition problems, general solution
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	"Advanced Engineering Mathematics" by Erwin Kreyszig	Available
Recommended Texts	"Principles of Mathematical Analysis" by Walter Rudin "Introduction to the Theory of Computation" by Michael Sipser	
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

Module Information					
Module Title	Electronics III			**Module Delivery**	
Module Type	C			☒Theory ☒Lecture ☒Lab ☒Tutorial ☐Practical ☐Seminar	
Module Code	EL315				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	3		**Semester of Delivery**	Five	
Administering Department			**College**		
Module Leader	Nawar Alseelawi		**e-mail**	Nawar.alseelawi@uomisan.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	M.Sc.	
Module Tutor	Nawar Alseelawi		**e-mail**	Nawar.alseelawi@uomisan.edu.iq	
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0	

Relation with other Modules			
Prerequisite module	Electronics I	**Semester**	Three
Co-requisites module	Electronics I	**Semester**	Four

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	95. Understand the principles and applications of operational amplifiers. 96. Gain knowledge about the ideal Op-Amp and basic Op-Amp configurations. 97. Learn how to perform an ideal Op-Amp circuit analysis. 98. Get familiarized with Op Amp specifications including DC offset parameters and frequency parameters. 99. Develop an understanding of important characteristics such as gain-bandwidth, slew rate, and maximum signal frequency. 100. Understand the concept of negative feedback in amplifiers. 101. Get introduced to the ideal feedback topologies and their applications. 102. Gain knowledge on impedance in feedback amplifiers. 103. Learn about practical feedback amplifiers, including voltage feedback, transconductance feedback, and transresistance feedback, along with their implementation in Op-Amp, FET, and BJT amplifiers. 104. Learn the principles and applications of active filters. 105. Understand the transmission, types, and specifications of filters. 106. Gain insight into Butterworth and Chebyshev Filters. 107. Get a comprehensive understanding of the active low-pass, high-pass, band-pass, and band-stop filters. 108. Learn to implement and design these filters in different scenarios. This module aims to enhance your understanding of electronic systems, their design, and their practical applications. You'll learn about various types of amplifiers and filters, their inner workings, and their usage in various electronic configurations. This knowledge will provide a foundation for more complex electronics study and can be applicable in various engineering fields such as telecommunications, signal processing, and more.
Module Learning Outcomes	99. Describe the function and operation of operational amplifiers. 100. Distinguish between different types of operational amplifier configurations including inverting, noninverting, and voltage follower. 101. Perform circuit analysis on ideal Op-Amp systems. 102. Understand and calculate DC offset parameters and frequency parameters of Op-Amps. 103. Analyze and interpret amplifier specifications including gain-bandwidth, slew rate, and maximum signal frequency. 104. Explain the concept and significance of negative feedback in amplifiers. 105. Identify and apply the ideal feedback topologies in various amplifier designs. 106. Understand and calculate input and output impedances in feedback

	amplifiers. 107. Design and analyze practical feedback amplifiers with respect to voltage, transconductance, and transresistance feedback. 108. Define and explain the concept and application of active filters. 109. Understand and apply knowledge of filter transmission, types, and specifications. 110. Design and implement Butterworth and Chebyshev Filters. 111. Create and analyze active low-pass, high-pass, band-pass, and band-stop filters. 112. Demonstrate competency in the design and application of different active filter circuits. By the end of this module, students should be capable of effectively using this knowledge in their further studies and professional work, displaying proficiency in the analysis and design of circuits involving operational amplifiers and active filters. They should also be able to adapt and apply these concepts to solve real-world electronics challenges.
Indicative Contents	Indicative content includes the following. **Chapter One - Operational Amplifier:** Amplifier Fundamentals, Operational Amplifier, Basic Op-Amp Configurations, Ideal Op-Amp Circuit Analysis, Op Amp Specifications – DC Offset Parameters, Op Amp Specifications – Frequency Parameters [18 Hours] **Chapter Two: Feedback Amplifier:** Negative Feedback, Ideal Feedback Topologies, Impedance in Feedback Amplifiers, Practical Feedback Amplifiers [18 Hours] **Chapter Three: Active Filter** Introduction, Filter Transmission, Types, and Specifications, Butterworth and Chebyshev Filters, Active Low-Pass Filter, Active High-Pass Filter, Active Band-Pass Filter, Active Band-Stop Filter [15 Hours]

Learning and Teaching Strategies	
Strategies	**1. Lectures:** Traditional lectures will be used to deliver fundamental knowledge, clarify complex concepts, and guide students through key aspects of operational amplifiers, feedback amplifiers, and active filters. This will include a mix of theoretical concepts and practical examples.

	2. Interactive Learning Sessions: To ensure active engagement, interactive sessions like question-and-answer rounds, quizzes, or brief discussions on specific topics can be conducted. These sessions can be helpful to check immediate understanding and clear any doubts or misconceptions. **3. Laboratory Work:** Practical lab sessions are essential for understanding electronics. Students will work with operational amplifiers and active filters in the lab to gain hands-on experience and knowledge about these components. **4. Group Projects and Assignments:** Students will be assigned projects and homework assignments that require the application of concepts learned in the lectures and labs. This would help to enhance problem-solving skills and reinforce their understanding. **5. Online Learning Resources:** Access to digital learning resources, such as online tutorials, e-books, and academic articles, can supplement the traditional classroom and lab learning experience. **6. Guest Lectures:** Inviting industry professionals and academic experts can provide students with different perspectives and applications of the concepts they're learning in the real world. **7. Feedback and Revision Sessions:** Regular feedback sessions should be conducted to address student queries and provide clarification on complex topics. Additionally, revision sessions before major assessments would be beneficial. **8. Self-study:** Encouraging students to independently explore topics outside of the course material can foster a deeper understanding and curiosity about electronics. These strategies aim to provide a varied and comprehensive learning experience, combining theoretical knowledge with practical skills and independent learning. This multi-faceted approach prepares students for future academic study or work in the electronics industry.

Student Workload (SWL)			
Structured SWL (h/sem)	79	**Structured SWL (h/w)**	5.2
Unstructured SWL (h/sem)	46	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	125		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	2	10% (10)	6 and 15	LO #1, #2 and #10, #11
	Assignments	2	5% (5)	3 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	25% (25)	Continuous	All
Summative assessment	**Midterm Exam**	2 hrs.	10% (10)	10	LO #1 - #7
	Final Exam	3 hrs.	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**<u>Chapter One: Operational Amplifier</u>** 1.1 Introduction 1.2 Amplifier Fundamentals 1.3 Operational Amplifier 1.3.1 The Ideal Op-Amp 1.4 Basic Op-Amp Configurations 1.4.1 The Inverting Configuration 1.4.2 The Noninverting Configuration 1.4.3 The Voltage Follower
Week 2	1.5 Ideal Op-Amp Circuit Analysis 1.5.1 Summing Amplifier 1.5.2 The Difference Amplifier 1.5.2.1 Input Signal Modes 1.5.2.2 Common-Mode Rejection Ratio
Week 3	1.5.3 The Integrator Amplifier 1.5.4 The Differentiator Amplifier
Week 4	1.6 Op Amp Specifications – DC Offset Parameters 1.6.1 Offset Currents and Voltages
Week 5	1.7 Op Amp Specifications – Frequency Parameters

	1.7.1 Gain–Bandwidth 1.7.1.1 $3\ dB$ Open-Loop Bandwidth 1.7.1.2 Closed-Loop Bandwidth 1.7.2 Slew Rate (SR) 1.7.3 Maximum Signal Frequency
Week 6	**Chapter Two: Feedback Amplifier** 2.1 Negative Feedback **+ Quiz**
Week 7	2.2 Ideal Feedback Topologies 2.2.1 Voltage Amplifier (Series-Shunt) 2.2.2 Current Amplifier (Shunt-Series) 2.2.3 Transconductance Amplifier (Series-Series) 2.2.4 Transresistance Amplifier (Shunt-Shunt)
Week 8	2.3 Impedance in Feedback Amplifiers 2.3.1 Input Impedance – Series Mixing (Voltage & Transconductance) 2.3.2 Input Impedance – Shunt Mixing (Current & Transresistance) 2.3.3 Output Impedance – Series Sampling (Current & Transconductance) 2.3.4 Output Impedance – Shunt Sampling (Voltage & Transresistance)
Week 9	2.4 Practical Feedback Amplifiers 2.4.1 Voltage (Series-Shunt) Feedback 2.4.1.1 Op-Amp Amplifier 2.4.1.2 FET Amplifier 2.4.1.3 BJT Amplifier 2.4.2 Transconductance (Series-Series) Feedback 2.4.2.1 BJT Amplifier 2.4.3 Transresistance (Shunt-Shunt) Feedback 2.4.3.1 Op-Amp Amplifier 2.4.3.2 FET Amplifier
Week 10	**Midterm Exam**
Week 11	**Chapter Three: Active Filter** 3.1 Introduction 3.2 Filter Transmission, Types, and Specifications 3.2.1 Filter Transmission 3.2.2 Filter Types 3.2.3 Filter Response Specifications

	3.2.3.1 Low-Pass Filter 3.2.3.2 High-Pass Filter 3.2.3.3 Band-Pass Filter 3.2.4 Filter Transfer Function
Week 12	3.3 Butterworth and Chebyshev Filters 3.3.1 Butterworth Filter 3.3.1.1 Natural Mode Identification 3.3.2 Chebyshev Filter 3.3.3 The Damping Factor 3.3.4 Critical Frequency and Roll-Off Rate
Week 13	3.4 Active Low-Pass Filter 3.4.1 Single-Pole Filter 3.4.2 Sallen-Key Low-Pass Filter 3.4.3 Cascaded Low-Pass Filters 3.5 Active High-Pass Filter 3.5.1 Single-Pole Filter 3.5.2 Sallen-Key High-Pass Filter 3.5.3 Cascaded High-Pass Filter
Week 14	3.6 Active Band-Pass Filter 3.6.1 Cascaded Low-Pass and High-Pass Filter 3.6.2 Multiple-Feedback Band-Pass Filter 3.6.3 State-Variable Filter 3.6.4 The Biquad Filter 3.7 Active Band-Stop Filter 3.7.1 Multiple-Feedback Band-Stop Filter
Week 15	**Quizz**
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Experiment 1: OP-AMP CIRCUITS
Week 2	Experiment 2: OP-AMP APPLICATIONS
Week 3	Experiment 3: THE COMPARATOR
Week 4	Experiment 4: ACTIVE FILTERS

Week 5	Experiment 5: RC OSCILLATORS
Week 6	Experiment 6: LC OSCILLATORS
Week 7	**Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Robert L. Boylestad, “Electronic Devices and Circuit Theory”, 11TH Edition, Pearson Education Limited, 2015.	Yes
Recommended Texts	Thomas L. Floyd, “Electronic Devices, Electron Flow Version”, 9TH Edition, Pearson Education Limited, 2015.	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 FORM

Module Information				
Module Title	Control I		**Module Delivery**	
Module Type	Core		☒Theory ☐Lecture ☐Lab ☒Tutorial ☐Practical ☐Seminar	
Module Code	EL316			
ECTS Credits	4			
SWL (hr/sem)	100			
Module Level	3		**Semester of Delivery**	5
Administering Department	Electrical Dep.		**College**	Engineering
Module Leader	Hisham Dawood Salman		**e-mail**	Hisham.altai@uomisan.edu.iq
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	M.Sc
Module Tutor	Name (if available)		**e-mail**	E-mail
Peer Reviewer Name	Name		**e-mail**	E-mail
Scientific Committee Approval Date	01/06/2023		**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	109. Understand the fundamental concepts of control theory 110. Analyze linear control systems 111. Design and evaluate control systems 112. Apply control theory to practical systems 113. Understand advanced control techniques

	114. Simulate and analyze control systems 115. Evaluate stability and performance 116. Solve control system design problems
Module Learning Outcomes	**113. Introduction and review:** - Possess a basic understanding of control system engineering and be able to offer some illustrative examples and their relationship to key contemporary issues. - Be able to recount a brief history of control systems and their role in society. - Be capable of discussing the future of controls in the context of their evolutionary pathways. - Recognize the elements of control system design and possess an appreciation of controls in the context of engineering design. **114. Modeling in the Frequency Domain** - Find the Laplace transform of time functions and the inverse Laplace transform - Find the transfer function from a differential equation and solve the differential equation using the transfer function - Find the transfer function for linear, time-invariant electrical networks - Find the transfer function for linear, time-invariant translational mechanical systems - Find the transfer function for linear, time-invariant rotational mechanical Systems - Find the transfer function for linear, time-invariant electromechanical systems - Produce analogous electrical and mechanical circuits - Linearize a nonlinear system in order to find the transfer function **115. Reduction of Multiple Subsystems** - Reduce a block diagram of multiple subsystems to a single block representing the transfer function from input to output - Analyze and design transient response for a system consisting of multiple subsystems) - Convert block diagrams to signal-flow diagrams - Find the transfer function of multiple subsystems using Mason's rule - Represent state equations as signal-flow graphs - Represent multiple subsystems in state space in cascade, parallel, controller canonical, and observer canonical forms **116. Time Response** - Use poles and zeros of transfer functions to determine the time response of a control system - Describe quantitatively the transient response of first-order systems - Write the general response of second-order systems given the pole location - Find the damping ratio and natural frequency of a second-order system - Find the settling time, peak time, percent overshoot, and rise time for an underdamped second-order system - Approximate higher-order systems and systems with zeros as first- or

	second order systems - Describe the effects of nonlinearities on the system time response **117. Steady-State Errors** - Find the steady-state error for a unity feedback system - Specify a system's steady-state error performance - Design the gain of a closed-loop system to meet a steady-state error specification - Find the steady-state error for disturbance inputs - Find the steady-state error for nonunity feedback systems - Find the steady-state error sensitivity to parameter changes **118. Stability Analysis:** - Make and interpret a basic Routh table to determine the stability of a system - Make and interpret a Routh table where either the first element of a row is zero or an entire row is zero - Use a Routh table to determine the stability of a system represented in state space **119. Root Locus Techniques** - Define a root locus - State the properties of a root locus - Sketch a root locus - Find the coordinates of points on the root locus and their associated gains - Use the root locus to design a parameter value to meet a transient response specification for systems of order 2 and higher - Sketch the root locus for positive-feedback systems - Find the root sensitivity for points along the root locus **120. Design via Root Locus** - Use the root locus to design cascade compensators to improve the steady-state error - Use the root locus to design cascade compensators to improve the transient response - Use the root locus to design cascade compensators to improve both the steady-state error and the transient response - Use the root locus to design feedback compensators to improve the transient response - Realize the designed compensators physically
Indicative Contents	1. **Introduction and review**: Systems, plant, linear dynamical systems, open loop and closed loop (feedback) systems. **2. Modeling in the Frequency Domain** Laplace transform of time functions and the inverse Laplace transform, solve the differential equation using the transfer function, Mathematical model of Linearize a nonlinear system in order to find the transfer function **3. Reduction of Multiple Subsystems** block diagrams, signal flow graph, Mason's rule.

	4. Time Response Use poles and zeros of transfer functions to determine the time response of a control system, first-order systems response, second-order systems response the damping ratio and natural frequency of a second-order system, the settling time, peak time, percent overshoot, and rise time for an underdamped second-order system , effects of nonlinearities on the system time response **5. Steady-State Errors** the steady-state error for a unity feedback system, a system's steady-state error performance, the steady-state error for disturbance inputs, the steady-state error for nonunity feedback systems, the steady-state error sensitivity to parameter changes **6. Stability Analysis:** basic Routh table to determine the stability of a system, Routh table where either the first element of a row is zero or an entire row is zero **7. Root Locus Techniques** Define a root locus, State the properties of a root locus, Sketch a root locus, coordinates of points on the root locus and their associated gains, Use the root locus to design a parameter value to meet a transient response specification for systems of order 2 and higher, Sketch the root locus for positive-feedback systems, the root sensitivity for points along the root locus **8. DESIGN VIA ROOT LOCUS** Introduction, Improving Steady-State, Improving Transient Response via Cascade Compensation, Improving Steady-State Error and Transient Response Feedback Compensation Physical Realization of Compensation Error via Cascade Compensation

Learning and Teaching Strategies	
Strategies	- Active learning: Encourage students to actively engage with the course material through activities such as discussions, group work, case studies, and problem-solving exercises. This helps students to construct their own understanding of the subject matter and promotes critical thinking skills. - Real-world applications: Connect the course material to real-world examples and applications to help students see the relevance and practicality of what they are learning. This can be done through case studies, field trips, or project-based assignments. - Technology integration: Utilize technology tools and resources to enhance learning experiences. This can include multimedia presentations, online discussion forums, virtual labs, interactive simulations, and educational apps. Technology can facilitate active learning, provide additional resources, and enable collaboration among students. - Differentiation: Recognize and accommodate the diverse learning needs and

	preferences of students. Offer a variety of instructional approaches, such as visual, auditory, and kinesthetic activities, to cater to different learning styles. Provide additional support or challenges based on individual student needs. - Formative assessment: Incorporate ongoing formative assessments throughout the course to monitor student progress and provide timely feedback. This can include quizzes, short assignments, class discussions, or group presentations. Formative assessments help identify areas where students may need additional support and allow for course adjustments as needed. - Break down complex concepts into smaller, manageable parts and provide support and guidance as students build their knowledge and skills. - Collaborative learning: Foster a collaborative and inclusive learning environment where students can learn from and with each other. Encourage group work, peer feedback, and discussions to promote active engagement, teamwork, and the exchange of ideas. - Reflection and metacognition: Incorporate opportunities for students to reflect on their learning and develop metacognitive skills. Encourage self-assessment, journaling, or class discussions where students can analyze their learning process, identify strengths and weaknesses, and set goals for improvement. - Flexibility and adaptability: Recognize that students have different learning paces and preferences. Provide flexibility in terms of pacing, content delivery, and assessment methods to accommodate diverse learning needs and promote student engagement. - Continuous improvement: Regularly evaluate the effectiveness of teaching strategies and make adjustments based on student feedback, assessment results, and your own observations. Reflect on the outcomes of the course and seek opportunities for improvement in future iterations.

Student Workload (SWL)			
Structured SWL (h/sem)	48	**Structured SWL (h/w)**	3
Unstructured SWL (h/sem)	52	**Unstructured SWL (h/w)**	3.7
Total SWL (h/sem)	**100**		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**INTRODUCTION** - Brief History of Automatic Control - System Configurations and Analysis - Different Between Closed- and Open-Loop - Applications of control systems
Week 2	**MODELING IN THE FREQUENCY DOMAIN** - Laplace Transform Review - The Transfer Function - Electrical Network Transfer Functions, - Translational Mechanical System Transfer Functions
Week 3	**MODELING IN THE FREQUENCY DOMAIN** - Rotational Mechanical System Transfer Functions - Electromechanical System Transfer Functions

	- Electric Circuit Analogs - Nonlinearities - Linearization
Week 4	**REDUCTION OF MULTIPLE SUBSYSTEMS** - Introduction - Block Diagrams - Analysis and Design of Feedback Systems - Signal-Flow Graphs - Mason's Rule
Week 5	**TIME RESPONSE** - Introduction - Poles, Zeros, and System Response - First-Order Systems - Second-Order System - Underdamped Second-Order Systems - Delay time, Rise time, Peak time, Settling time, Maximum overshoot
Week 6	**TIME RESPONSE** - System Response with Additional Poles - System Response with Zeros - Effects of Nonlinearities upon Time Response - System Response with Additional Poles - System Response with Zeros - Effects of Nonlinearities upon Time Response
Week 7	**Mid Term**
Week 8	**STEADY-STATE ERRORS** - Introduction - Steady-State Error for Unity Feedback Systems - Static Error Constants and System Type
Week 9	**STEADY-STATE ERRORS** - Steady-State Error Specifications - Steady-State Error for Disturbances - Steady-State Error for Nonunity Feedback Systems - Sensitivity
Week 10	**STABILITY**

	- Introduction - Routh-Hurwitz Criterion
Week 11	**STABILITY** - Routh-Hurwitz Criterion: Special Cases
Week 12	**ROOT LOCUS TECHNIQUES** - Introduction - Defining the Root Locus - Properties of the Root Locus - Sketching the Root Locus - Refining the Sketch
Week 13	**ROOT LOCUS TECHNIQUES** - Transient Response Design via Gain Adjustment - Generalized Root Locus - Root Locus for Positive-Feedback Systems - Pole Sensitivity
Week 14	**DESIGN VIA ROOT LOCUS** - Introduction - Improving Steady-State - Improving Transient Response via Cascade Compensation
Week 15	**DESIGN VIA ROOT LOCUS** - Improving Steady-State Error and Transient Response - Feedback Compensation - Physical Realization of Compensation Error via Cascade Compensation
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	CONTROL SYSTEMS ENGINEERING BY NORMAN S. NISE K. OGATA, MODERN CONTROL ENGINEERING,5TH EDITION	Yes
Recommended Texts	Modern Control Systems (Richard C. Dorf & Robert H. Bishop)	Yes
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

Module Information				
Module Title	Electrical machines IV		**Module Delivery**	
Module Type	Core		☒Theory ☐ Lecture ☒Lab ☒Tutorial ☐Practical ☐Seminar	
Module Code	EL321			
ECTS Credits	6			
SWL (hr/sem)	150			
Module Level	3		**Semester of Delivery**	SIX
Administering Department	Ele. Eng. Dep.		**College**	Engineering
Module Leader	Mohammed H. Lazim		**e-mail**	Mohammed.hasan@uomisan.edu.iq
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	M.Sc.
Module Tutor	Mohammed H. Lazim		**e-mail**	Mohammed.hasan@uomisan.edu.iq
Peer Reviewer Name	Name		**e-mail**	E-mail
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0

Relation with other Modules			
Prerequisite module	Electrical machines I& II&III, Electrical Circuit I& II, Fundamental of EE I &II.	**Semester**	1,2,3,4,5
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	Generally, the aims of this module are to give the students adequate knowledge about synchronous machines, (synchronous generators, and synchronous motor), enabling them to understand their principles, analyze their performance and apply this knowledge in practical applications in various industries. Objectives can be described in detail in the following points: 10. Understanding the basic principles of synchronous machines: Students should be able to digest the fundamental concepts and principles behind the operation including the concept of synchronous speed, excitation, relation between rotor speed and generated frequency, and the interaction between rotor and the armature. 11. Describe the construction of synchronous machines: Students should be able to describe the constructional features (salient and non-salient pole types) and the equivalent circuit of Synchronous machines. 12. Analyze the performance characteristics of Synchronous machines: Students should be able to analyze and interpret the performance characteristics of synchronous machines, including linear and nonlinear methods. 13. Calculation the voltage regulation of large synchronous machine: in this module, students should recognize how to determine the voltage regulation from no load test and blocked rotor test, using M.M.F method, E.M.F method and Potier triangle method for cylindrical rotor type, and two reactance method for salient rotor type. 14. Determination the power and torque: Adequate details in this module to derive equations to calculate the developed power and maximum power of the synchronous machines. 15. Understanding the parallel operation of synchronous generators: Parallel operation of synchronous generator can be considered the most important subtitle in this module: students should be learning the conditions to connect two generators or more in parallel, synchronization, methods to connect an alternator to an infinity busbar. 16. Understand the control of synchronous machines: Students should have a solid understanding about the effect of changing rotor excitation, load, and the speed of the prime mover on the synchronising current and synchronising power. 17. Starting of synchronous motors: students should have enough knowledge about the starting methods to start the synchronous motor. 18. Applications: In this Module, students should have sufficient knowledge about the application of cylindrical generators and salient rotor generators, As well as the application of the synchronous motor when it works as synchronous condenser. 19. Hunting effect: students should understand the effect of hunting and causes and the role of damper windings in generator mode as well as in motor mode. 20. Analyse and troubleshoot Synchronous machine faults: Students should be able to analyse and troubleshoot common faults and problems that can occur in Synchronous machines, such as unbalanced voltages, rotor faults, stator faults, and bearing failures. 21. Develop laboratory skills: Students should develop practical skills in conducting experiments and practical exercises related to Synchronous machines, including performance testing, efficiency measurement, and fault diagnosis. 22. Communicate effectively: Students should be able to effectively communicate their ideas and findings related to Synchronous machines, both in written reports and oral presentations.
Module Learning Outcomes	The module learning outcomes of studying the synchronous machines in the third year of undergraduate study: 121. To understand the basic principles of synchronous machines. This includes understanding the physical construction of synchronous machines (synchronous

	generator, and synchronous motors), recognize the rotating magnetic field theory. 122. To learn the various types of the synchronous generators and their advantages and disadvantages and the appropriate application of each one. 123. To determine the electrical parameters of the equivalent circuit of the synchronous machines. Including calculation, the armature (synchronous) reactance, leakage reactance, Armature resistance, generated emf, and internal e.m.f. 124. To realize the effect of armature reaction on internal e.m.f . 125. To study the analysis the operation of the synchronous machines and determine the voltage regulation from no load test and blocked rotor test, using synchronous impedance method, m.m.f. method and Potier triangle method. 126. To calculate the developed power, power factor, losses, and torque as well as how to gain maximum torque from the synchronous machines. 127. To learn the parallel operation of synchronous generators as well as the conditions and methods to connect an alternator to an infinity busbar. 128. To learn the starting methods of synchronous motor. 129. To discuss the effect of excitation of power factor of synchronous motor. 130. To know the appropriate application of the synchronous machines. 131. To realize the hunting effect in synchronous machine.
Indicative Contents	Indicative content includes the following. **1. Synchronous Generator.** Main constructional features of commutator and brushless excitation system, Generation of three phase emf, Production of rotating magnetic field in a three-phase winding, Concept of distribution factor and coil span factor and emf equation Armature reaction on unity, lag and lead power factor, Operation of single synchronous machine independently supplying a load Voltage regulation by synch. impedance method, Need and necessary conditions of parallel operation of alternators Synchronizing an alternator (Synchroscope method) with the busbars. **2. Synchronous motor.** Principle operation of synchronous machine as a motor, its starting methods, Effect of change in excitation of a synchronous motor, Cause of hunting and prevention, Rating and cooling of synchronous machines, Applications of synchronous motor as a synchronous condenser.

Learning and Teaching Strategies	
Strategies	The following strategies can be used to help the students to digest the information simply: 1. Interactive lectures :Using multimedia in the classes like animated video about the working principles of electrical machines enhances the imagination of the students. Also engaging students in group discussions promotes active learning and encourages peer-to-peer interaction. 2. Choosing the interactive tutorials and examples of real numbers from the laboratory or familiar in the industry. 3. Using the laboratories as an approach to link the theoretical aspect with reality and simplify understanding of the curriculum with interactive experiments. 4. Practical activities: Assigning interesting practical activities to develop students' creativity. 5. Computer Simulations: Utilizing computer simulations and software tools can provide a virtual environment for students to experiment with Synchronous

	machines. Simulations can help students visualize complex concepts and observe the impact of different parameters on machine performance. 6. Case Studies: Presenting real-life case studies or industry examples can help students understand how synchronous machines are used in practical applications. This can enhance their problem-solving skills and critical thinking abilities. 7. Assessments: Conduct regular assessments, quizzes, and examinations to gauge students' understanding and monitor their progress. This provides feedback and identifies areas where additional support or clarification may be required.

Student Workload (SWL)			
Structured SWL (h/sem)	94	**Structured SWL (h/w)**	6.266
Unstructured SWL (h/sem)	56	**Unstructured SWL (h/w)**	3.733
Total SWL (h/sem)	**150**		

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.	7	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	3 hr.	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Synchronous Machines (Alternators): Working principle, construction, salient and non-salient pole types, relation between speed and frequency.
Week 2	Equivalent circuit, phasor diagram, generated E.M.F equation, factors affecting on the generated E.M.F and armature reaction equation.
Week 3	Voltage regulation, linear and no linear analysis, M.M.F method (general method).
Week 4	E.M.F. method (Synchronous impedance method) and Determination the leakage reactance and armature reactance, Potier triangle method.

Week 5	Power stages, efficiency, and losses of synchronous generator, maximum developed torque of cylindrical rotor.
Week 6	Theory of salient-pole machines (two-reactance and general methods), E.M.F. method, slip-test.
Week 7	Mid- term +Torque and power equations of a synchronous generator of salient pole rotor.
Week 8	Parallel operation of synchronous generators, Conditions for Paralleling an alternator with infinite busbars, Synchronization, Methods of synchronization.
Week 9	Performance of generator connected to infinite-busbar.
Week 10	Synchronizing current, Synchronizing power and torque, effect of unequal voltage, distribution of load and V-curves of synchronous generator.
Week 11	Effect of change of field excitation, Effect of change in mechanical input.
Week 12	Synchronous motors: Construction and working principle, phasor diagram and equivalent circuit.
Week 13	Starting methods, power stages, torque developed, and the efficiency of synchronous motor.
Week 14	Effect of excitation on armature current and power factor, V-curves of synchronous motors.
Week 15	Hunting of synchronous motor and finally Synchronous condenser .
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Working principal test of synchronous generator, types of excitations, configurations of the armature windings, and the equivalent circuit.
Week 2	Generated e.m.f test and relation between the speed of a prime mover and the generated frequency of a synchronous generator.
Week 3	Voltage regulation test, study the effect of armature reaction at different loads on a synchronous generator.
Week 4	Load test and determination the efficiency at various loads.
Week 5	Working principal test of synchronous motor, Starting test of synchronous motors
Week 6	Power factor of the synchronous motor and study V-curves of the synchronous motor
Week 7	Synchronous motor as a synchronous condenser and the applications of synchronous motor

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Theraja BL Theraja AK. A Textbook of Electrical Technology. New Delhi India: S. Chand;	Yes
Recommended Texts	Principles of electrical machines V.K. Mehta, Rohit Mehta, Pub, S. Chand, India	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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Power System II</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">C</td><td colspan="2" rowspan="4">☒Theory
☐Lecture
☐Lab
☐Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">EL322</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">125</td></tr>
<tr><td>Module Level</td><td>3</td><td colspan="2">Semester of Delivery</td><td colspan="2">Six</td></tr>
<tr><td>Administering Department</td><td>Electrical Dep.</td><td>College</td><td colspan="3">Engineering</td></tr>
<tr><td>Module Leader</td><td>Name</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Professor</td><td colspan="2">Module Leader’s Qualification</td><td colspan="2">Ph.D.</td></tr>
<tr><td>Module Tutor</td><td>Name (if available)</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Peer Reviewer Name</td><td>Name</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Scientific Committee Approval Date</td><td>01/06/2023</td><td colspan="2">Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>Power System I</td><td>Semester</td><td>5</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	117. To study the main parameters of transmission line 118. To design the optimal transmission line 119. To enhance the performance of transmission line 120. To understand the Distribution System 121. To study the types of the Distribution System 122. To recognize the types of control system in the power system
Module Learning Outcomes	132. Recognize the major parameters of hight voltage of transmission line 133. Discuss the resistance, inductance and capacitance in the transmission line 134. Analysis the types of transmission line 135. Discuss the performance of transmission line based on area 136. Describe the Distribution System. 137. Recognize the major types of Distribution System.
Indicative Contents	Indicative content includes the following. **Transmission Line Parameters** Line resistance, line inductance, single-phase line with multi-conductors, bundling, line inductance of three-phase transmission systems, single-phase and three-phase capacitance. [25 hrs] **Electrical Characteristics of Overhead Transmission Lines** Representation of lines, short, medium, long T.L., the equivalent circuit of a long transmission line, power factor flow through a transmission line, power circle diagram, line regulation, reactive compensation of transmission line. [25 hrs] **Distribution System Configuration:** Various distribution system circuit components, representation and parameters radial, ring, spike, spindle, and interconnected systems. [20 hrs] **Electrical Design of Distribution Systems:** Voltage level, selecting various system components, transformers, cables, overhead lines, switching and protective gear, voltage drop & power loss calculations, economic considerations. [20 hrs] **Distribution inside Large Buildings:** Single rising mains, individual floor supply, ring supply, double feed and grouped supply, vertical and horizontal supply systems, main, sub main, and final distribution boards. [15hrs] **Industrial Power Distribution:** Special features, equipment layout, cable trenches, cable trays, Grounding, emergency power supply. [10 hrs]

Learning and Teaching Strategies	
Strategies	Type something like: 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.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4.2
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**		10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments		10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.		10% (10)	Continuous	All
	Report		10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**		10% (10)	7	LO #1 - #7
	Final Exam		50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Line resistance, line inductance, single-phase line with multi-conductors, bundling,
Week 2	Line inductance of three-phase transmission systems,
Week 3	Single-phase and three-phase capacitance.
Week 4	Representation of lines, short, medium, long T.L.,
Week 5	the equivalent circuit of a long transmission line,
Week 6	power factor flow through a transmission line,
Week 7	power circle diagram, line regulation, reactive compensation of transmission line
Week 8	Various distribution system circuit components,
Week 9	Representation and parameters radial, ring, spike, spindle, and interconnected systems
Week 10	Voltage level, selecting various system components, transformers, cables, overhead lines
Week 11	voltage drop & power loss calculations, economic considerations.
Week 12	Single rising mains, individual floor supply, ring supply, double feed and grouped supply,
Week 13	vertical and horizontal supply systems, main, sub main, and final distribution boards
Week 14	Special features, equipment layout, cable trenches, cable trays,
Week 15	Grounding, emergency power supply
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	ESSENTIAL READING 2. V. K. Mehta and Rohit, "**Principles of Power System**", S. Chand, 2005	
Recommended Texts	RECOMMENDED READING 4. Stevenson, W. D. (1994). **Power Systems: Analysis and Design**. McGraw-Hill. 5. Hadi Saadat, "**Power System Analysis**", Tata McGraw-Hill, 2002. 6. T. K. Nagsarkar, "**Power System Analysis**", Oxford University Press, 2014.	
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

Module Information					
Module Title	Communication II			**Module Delivery**	
Module Type	Core			☒Theory ☐Lecture ☒Lab ☒Tutorial ☐Practical ☐Seminar	
Module Code	EL323				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	3			**Semester of Delivery**	six
Administering Department	Electrical Dep.			**College**	Engineering
Module Leader	Name			**e-mail**	E-mail
Module Leader's Acad. Title	Professor			**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	01/06/2023			**Version Number**	1.0

Relation with other Modules			
Prerequisite module	Communication I (EL313)	**Semester**	5
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	123. To explore the concept of sampling theorem. 124. To learn about various technique of pulse modulation (PAM,PWM,PPM) 125. To understand the signal multiplexing techniques like FDM and TDM 126. To study the theory behind demodulation techniques for recovering the original message signal from modulated signals. 127. This course deals with pulse code modulation PCM, types and applications. 128. To understand Delta modulation DM types and applications. 129. To perform signaling format and sinusoidal digital modulation. 130. To understand transmission line concepts
Module Learning Outcomes	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 138. Discus the Nyquist sampling theorem. 139. Analysis the process of sampling in time and frequency domains. 140. Summarize what is meant by a pulse modulation. 141. Describe PAM, PWM and PPM. 142. Identify the generation and detection of pulse modulation . 143. Discuss the signal formatting. 144. Explain the sinusoidal digital formation. 145. Identify the characteristics of transmission line concepts.
Indicative Contents	Indicative content includes the following. **Digital communication** Nyquist sampling theorem, pulse modulation PAM, PWM, PPM, time division multiplexing (TDM) [10 hrs] Noise in pulse modulation ,pulse code modulation PCM/TDM, data modulation (DM), quantization noise in PCM and DM [15 hrs] signaling format (unipolar , bipolar , and spilt- phase Manchester), sinusoidal digital modulation ASK, PSK, FSK, noise in ASK, PSK, FSK, (error probability using coherent matched filter and noncoherent detection) [15 hrs] **Transmission line** Equivalent circuit, characteristic impedance , phase velocity ,reflection coefficient, standing wave,quarter-wave transformer, smith chart calculation and stub matching.[15 hrs]

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 types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	94	**Structured SWL (h/w)**	6
Unstructured SWL (h/sem)	56	**Unstructured SWL (h/w)**	3
Total SWL (h/sem)	**150**		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	sampling theorem
Week 2	pulse modulation PAM
Week 3	pulse modulation PWM AND PPM
Week 4	Signal multiplexing TDM and FDM
Week 5	pulse code modulation PCM
Week 6	data modulation (DM)
Week 7	Midterm
Week 8	signaling format (unipolar , bipolar , and spilt- phase Manchester),

Week 9	quantization noise in PCM and DM
Week 10	sinusoidal digital modulation ASK, PSK, FSK,
Week 11	noise in ASK, PSK, FSK
Week 12	Transmission line :Equivalent circuit
Week 13	characteristic impedance , phase velocity
Week 14	reflection coefficient, standing wave,quarter-wave transformer
Week 15	smith chart calculation and stub matching.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Signal analysis
Week 2	AM modulation
Week 3	AM demodulation
Week 4	FM modulation
Week 5	FM demodulation
Week 6	Analysis of sampling theorem

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Modern Digital and Analog Communication systems –b.P Lathi	
Recommended Texts	Communication systems –by A B Carson	
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

Module Information					
Module Title	**Numerical Analysis II**		**Module Delivery**		
Module Type	**B**		☒ Theory ☐ Lecture ☐ Lab ☒ Tutorial ☐ Practical ☐ Seminar		
Module Code	**EL324**				
ECTS Credits	**5**				
SWL (hr/sem)	**125**				
Module Level	3		**Semester of Delivery**	six	
Administering Department	Electrical Dep.		**College**	Engineering	
Module Leader	Murtadha Saeed Mohammed		**e-mail**	murtadha.saeed@uomisan.edu.iq	
Module Leader's Acad. Title	Asst.Lecturer		**Module Leader's Qualification**	MS.c	
Module Tutor	Murtadha Saeed Mohammed		**e-mail**	murtadha.saeed@uomisan.edu.iq	
Peer Reviewer Name			**e-mail**		
Scientific Committee Approval Date	01/06/2023		**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	131. Understand the principles and techniques of Numerical Analysis II. 132. Develop skills in applying mathematical and computational methods to solve Numerical engineering problems. 133. To develop problem solving skills and understanding Solution of non-linear equations. 134. To understand Solving sets of linear equations. 135. Learn how to analyze Numerical interpolation problems. 136. Develop a strong foundation for solution of Differential Equations using numerical methods.
Module Learning Outcomes	146. Design and optimize engineering systems, considering factors such as efficiency, safety, and sustainability. 147. Applying Finite Difference Method for using LaGrange's interpolation & Newton's Interpolation 148. Analysis nonlinear equations, applications. 149. Evaluate the accuracy, stability, and convergence of numerical methods used in engineering analysis. 150. Design and optimize engineering systems by integrating engineering principles and numerical analysis methods. 151. Perform the Solution of Differential Equations using numerical analysis. 152. Communicate numerical analysis concepts and results effectively through written reports and presentations.
Indicative Contents	Indicative content includes the following. **<u>Numerical solutions of nonlinear equations:</u>** Why numerical methods, Solution of non-linear equations (roots finding): graphical method, bisection method, method of iteration, Newton's method, the secant method. [12hrs] **<u>Numerical solutions of linear system equations:</u>** Matrix notation, Gaussian elimination method, evaluation of the inverse of a matrix, matrix inverse method, LU factorization method, Gauss-Seidel iteration method, Eigen values and Eigen vectors. Solving set of set of nonlinear equations. [15hrs] **<u>Numerical differential & interpolation:</u>** Finite Difference Method (Forward, Backward & Divided difference), Polynomial interpolation, linear interpolation, quadratic interpolation, higher degree interpolation (LaGrange's interpolation), Newton's Interpolation, error in polynomial interpolation. [15hrs] **<u>Numerical integration:</u>** Derivatives from interpolating polynomials, trapezoidal & Simpson's rules for numerical integration. [10hrs] **<u>Numerical solutions of ordinary differential equations:</u>** Euler Method, Modified Euler Method, Runge-Kutta Methods [8hrs]

Learning and Teaching Strategies	
Strategies	This module will be delivered through class lectures and tutorials where student will be able to understand the module content. Active learning will be implemented via collaborative group to solve exercise, assignments and projects.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4.2
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**		10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments		10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects		10% (10)	Continuous	All
	Report		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	Introduction, Solution of non-linear equations (roots finding) graphical method, bisection method
Week 2	Solving Nonlinear Equation by method of iteration, Newton's method
Week 3	Solving Nonlinear Equation by the secant method
Week 4	Matrix notation, Gaussian elimination method
Week 5	Gauss-Seidel iteration method, Gauss-Jrodan Elimination Method
Week 6	evaluation of the inverse of a matrix, matrix inverse method, LU factorization method
Week 7	Mid- term + Eigenvalue and Eigenvectors. Methods of evaluation matrix function.
Week 8	Finite Difference Method Forward difference
Week 9	Finite Difference Method Backward & Divided difference
Week 10	Polynomial interpolation, linear interpolation, quadratic interpolation, higher degree interpolation (LaGrange's interpolation)
Week 11	Newton's Interpolation, error in polynomial interpolation.
Week 12	Derivatives from interpolating polynomials trapezoidal rules for numerical integration
Week 13	Simpson's rules for numerical integration
Week 14	Initial value problems by Euler and modified Euler Method,
Week 15	4^{th}order Runge-Kutta Methods
Week 16	Preparatory week before the final Exam

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	"Advanced Engineering Mathematics" by Erwin Kreyszig	Available
Recommended Texts	''Advanced Engineering Mathematics'' by Dennis G.Zill "Principles of Mathematical Analysis" by Walter Rudin	Available
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

Module Information				
Module Title	Electronics IV		**Module Delivery**	
Module Type	C		☒Theory ☒Lecture ☐Lab ☒Tutorial ☐Practical ☒Seminar	
Module Code	EL325			
ECTS Credits	4			
SWL (hr/sem)	100			
Module Level	3		**Semester of Delivery**	Six
Administering Department	Electrical Dep.		**College**	Engineering
Module Leader	Nawar Alseelawi		**e-mail**	Nawar.alseelawi@uomisan.edu.iq
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**	M.Sc.
Module Tutor	Nawar Alseelawi		**e-mail**	Nawar.alseelawi@uomisan.edu.iq
Peer Reviewer Name			**e-mail**	
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0

Relation with other Modules			
Prerequisite module	Electronics II	**Semester**	Four
Co-requisites module	Electronics III	**Semester**	Five

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	137. Understand the principles and applications of oscillators in electronics. 138. Grasp the concepts of feedback oscillators, including the requirement of positive feedback and conditions for oscillation. 139. Learn about the different types of RC and LC oscillators, including Wien-Bridge, Phase-Shift, Twin-T, Colpitts, Clapp, Hartley, Armstrong, and Crystal-Controlled Oscillators. 140. Acquire knowledge about relaxation oscillators, focusing on different waveform generation techniques. 141. Gain a comprehensive understanding of the concept of voltage regulation, including line and load regulations. 142. Learn about different voltage regulators, including linear series regulators, linear shunt regulators, and switching regulators. 143. Study various configurations of switching regulators, including step-down, step-up, and voltage-inverter configurations. 144. Understand the concepts of multivibrators, including monostable, astable, and bistable multivibrator circuits. 145. Get familiarized with different types of circuits used in multivibrators, using gates and transistors. 146. Learn about the IC 555 timer and its operations, including monostable and astable operations. The aim of this module is to provide students with a comprehensive understanding of oscillators, voltage regulators, and timing circuits, along with their design and practical applications. The gained knowledge and skills would be applicable in numerous areas of electronics engineering, including telecommunications, power systems, signal processing, and control systems.
Module Learning Outcomes	153. Explain the basic concepts and operations of oscillators. 154. Describe the purpose and function of feedback oscillators. 155. Distinguish between different types of RC and LC oscillators, and explain their operational principles. 156. Design and analyze circuits for different types of oscillators, including relaxation oscillators. 157. Describe the principles of voltage regulation, including line and load regulations. 158. Distinguish between different types of voltage regulators, including series, shunt, and switching regulators. 159. Design and analyze circuits for different types of voltage regulators and their configurations.

	160. Describe the principles of multivibrators and explain the functioning of monostable, astable, and bistable circuits. 161. Analyze and design various multivibrator circuits using gates and transistors. 162. Explain the functioning of the IC 555 timer in different modes and design relevant circuits. Upon successful completion of this module, students should be able to demonstrate a solid understanding of the operation, design, and practical applications of oscillators, voltage regulators, and timing circuits. This would enable them to apply these concepts in real-world electronics design and analysis tasks, enhancing their practical skills and industry-readiness.
Indicative Contents	Indicative content includes the following. **Chapter One - Oscillators:** The Oscillator, Feedback Oscillator, RC Oscillators, LC Oscillators, Relaxation Oscillators [15 Hours] **Chapter Two: Voltage Regulators:** Voltage Regulation, Basic Linear Series Regulators, Basic Linear Shunt Regulator, Basic Switching Regulators [15 Hours] **Chapter Three: Timing Circuits** Multivibrator, Monostable Multivibrator Circuits, Astable Multivibrator Circuits, Bistable Multivibrator Circuits, Schmitt Trigger, The IC 555 Timer, Monostable Operation, Astable Operation [12 Hours]

Learning and Teaching Strategies	
Strategies	**1. Lectures:** Lectures form the backbone of knowledge delivery, where the instructor presents the fundamental concepts, theories, and applications related to oscillators, voltage regulators, and timing circuits. **2. Demonstrations:** Instructor-led demonstrations of different oscillator types, voltage regulators, and timing circuits can provide students with a better understanding of the operational principles and designs. **3. Group Projects:** Group assignments and projects encourage students to collaboratively design, implement, and troubleshoot circuits. This can enhance teamwork and problem-solving skills.

	4. Self-Learning: Assignments and additional reading materials can be provided to encourage self-learning. Understanding electronics often requires self-paced study and practice. **5. Online Tutorials and Simulations:** Modern learning tools such as online circuit design and simulation platforms can be used to understand, visualize, and practice the design and analysis of electronic circuits. **6. Quizzes and Examinations:** Regular quizzes, midterm, and final examinations will be used to assess the student's understanding and knowledge of the topics. **7. Discussion Sessions:** Interactive sessions can be arranged to discuss the difficulties encountered during self-study or lab work, fostering a cooperative learning environment. **8. Feedback and Reflection:** Students should be encouraged to give and receive feedback on their work. This will help them identify their strengths and areas for improvement. These strategies aim to create a holistic learning environment that combines theoretical knowledge, practical skills, independent research, and teamwork. This comprehensive approach prepares students for a successful career in electronics and related fields.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4.2
Unstructured SWL (h/sem)	37	**Unstructured SWL (h/w)**	2.4
Total SWL (h/sem)	**100**		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**Chapter One: Oscillators** 1.1 The Oscillator 1.2 Feedback Oscillator 1.2.1 Positive Feedback 1.2.2 Conditions for Oscillation
Week 2	1.3 RC Oscillators 1.3.1 Wien-Bridge Oscillator 1.3.2 Phase-Shift Oscillator 1.3.3 Twin-T Oscillator
Week 3	1.4 LC Oscillators 1.4.1 Colpitts Oscillator 1.4.2 Clapp Oscillator 1.4.3 Hartley Oscillator 1.4.4 Armstrong Oscillator 1.4.5 Crystal-Controlled Oscillator
Week 4	1.5 Relaxation Oscillators 1.5.1 Triangular-Wave Oscillator 1.5.2 Sawtooth Voltage-Controlled Oscillator (VCO) 1.5.3 Square-Wave Oscillator

Week 5	**Quiz**
Week 6	**<u>Chapter Two: Voltage Regulators</u>** 2.1 Voltage Regulation 2.1.1 Line Regulation 2.1.2 Load Regulation
Week 7	2.3 Basic Linear Shunt Regulators
Week 8	2.4 Basic Switching Regulators 2.4.1 Step-Down Configuration 2.4.2 Step-Up Configuration 2.4.3 Voltage-Inverter Configuration
Week 9	**Midterm Exam**
Week 10	**<u>Chapter Three: Timing Circuits</u>** 3.1 Multivibrator 3.1.1 Monostable Multivibrator Circuits 3.1.1.1 Simple NAND Gate Monostable Circuit 3.1.1.2 NOT Gate Monostable Multivibrator
Week 11	3.1.1.3 NOR Gate Monostable Multivibrator 3.1.1.4 Monostable Multivibrator circuit using Transistors
Week 12	3.1.2 Astable Multivibrator Circuits 3.1.2.1 NAND Gate Astable Multivibrator 3.1.2.2 Astable multivibrator using NPN transistors 3.1.2.3 Switching Times and Frequency of Oscillation 3.1.3 Bistable Multivibrator Circuits 3.1.3.1 Schmitt Trigger
Week 13	3.2 The IC 555 Timer 3.2.1 Monostable Operation
Week 14	3.2.2 Astable Operation
Week 15	**Quiz**
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	Robert L. Boylestad, “Electronic Devices and Circuit Theory”, 11TH Edition, Pearson Education Limited, 2015.	Yes
Recommended Texts	Thomas L. Floyd, “Digital Fundamentals”, 11TH Edition, Pearson Education Limited 2015.	Yes
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

Module Information					
Module Title	Control II		**Module Delivery**		
Module Type	Core		☒Theory ☐Lecture ☐Lab ☒Tutorial ☐Practical ☐Seminar		
Module Code	EL326				
ECTS Credits	4				
SWL (hr/sem)	100				
Module Level	3		**Semester of Delivery**		6
Administering Department	Electrical Dep.		**College**	Engineering	
Module Leader	Hisham Dawood Salman		**e-mail**	Hisham.altai@uomisan.edu.iq	
Module Leader's Acad. Title	Lecturer		**Module Leader's Qualification**		M.Sc
Module Tutor	Name (if available)		**e-mail**	E-mail	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**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	147. Understand the fundamental concepts of control theory 148. Analyze linear control systems 149. Design and evaluate control systems 150. Apply control theory to practical systems 151. Understand advanced control techniques 152. Simulate and analyze control systems 153. Evaluate stability and performance 154. Solve control system design problems.
Module Learning Outcomes	**1- Frequency Response Techniques** - Define and plot the frequency response of a system - Plot asymptotic approximations to the frequency response of a system - Sketch a Nyquist diagram - Use the Nyquist criterion to determine the stability of a system - Find stability and gain and phase margins using Nyquist diagrams and Bode plots - Find the bandwidth, peak magnitude, and peak frequency of a closed-loop frequency response given the closed-loop time response parameters of peak time, settling time, and percent overshoot - Find the closed-loop frequency response given the open-loop frequency Response - Find the closed-loop time response parameters of peak time, settling time, and percent overshoot given the open-loop frequency response **2- Design via Frequency Response** - Use frequency response techniques to adjust the gain to meet a transient response specification - Use frequency response techniques to design cascade compensators to improve the steady-state error - Use frequency response techniques to design cascade compensators to improve the transient response - Use frequency response techniques to design cascade compensators to improve both the steady-state error and the transient response **3- State space analysis** - Find a mathematical model, called a state-space representation, for a linear, time invariant system - Model electrical and mechanical systems in state space - Convert a transfer function to state space - Convert a state-space representation to a transfer function - Linearize a state-space representation **4- Design via State Space** - Design a state-feedback controller using pole placement for systems represented in phase-variable form to meet transient response specifications Determine if a system is controllable - Design a state-feedback controller using pole placement for systems not represented in phase-variable form to meet transient response specifications

	- Design a state-feedback observer using pole placement for systems represented in observer canonical form - Determine if a system is observable - Design a state-feedback observer using pole placement for systems not represented in observer canonical form - Design steady-state error characteristics for systems represented in state space **5- PID Control Design** - Introduction - Ziegler–Nichols Rules for Tuning PID Controllers - Design of PID Controllers with Frequency-Response Approach Design of PID Controllers with Computational Optimization Approach - Modifications of PID Control Schemes - Two-Degrees-of-Freedom Control - Zero-Placement Approach to Improve Response Characteristics **6- Robust Control Systems** - Appreciate the role of robustness in control system design. - Be familiar with uncertainty models, including additive uncertainty, multiplicative uncertainty, and parameter uncertainty. - Understand the various methods of tackling the robust control design problem using root locus, frequency response, ITAE methods for PID control, internal model, and pseudo-quantitative feedback methods.
Indicative Contents	**1. FREQUENCY RESPONSE TECHNIQUES** Introduction, Asymptotic Approximations: Bode Plots, Introduction to the Nyquist Criterion, Sketching the Nyquist Diagram, Stability via the Nyquist Diagram, Gain Margin and Phase Margin via the Nyquist Diagram, Stability, Gain Margin, and Phase Margin via Bode Plots, Relation Between Closed-Loop Transient and Closed-Loop Frequency Responses, Relation Between Closed- and Open-Loop Frequency Responses, Relation Between Closed-Loop Transient and Open-Loop Frequency Responses, Steady-State Error Characteristics from Frequency Response, Systems with Time Delay **2. DESIGN VIA FREQUENCY RESPONSE** Transient Response via Gain Adjustment, Lag Compensation, Lead Compensation, Lag-Lead Compensation, **3. STATE SPACE ANALYSIS** Introduction, Some Observations, The General State-Space Representation, Applying the State-Space Representation, Converting a Transfer Function to State Space, Converting from State Space to a Transfer Function, Linearization, **4. DESIGN VIA STATE SPACE** Introduction, Controller Design, Controllability, Alternative Approaches to Controller Design, Observer Design, Observability, Alternative Approaches to Observer Design, Steady-State Error Design via Integral Control, **5. PID CONTROL DESIGN** Introduction, Ziegler–Nichols Rules for Tuning PID Controllers, Design of PID, Controllers with Frequency-Response Approach Design of PID Controllers with

	Computational Optimization Approach, Modifications of PID Control Schemes, Two-Degrees-of-Freedom Control, Zero-Placement Approach to Improve Response Characteristics **6. ROBUST CONTROL SYSTEMS** Introduction, Robust Control Systems and System Sensitivity, Analysis of Robustness, Systems with Uncertain Parameters, The Design of Robust Control Systems, The Design of Robust PID-Controlled Systems, The Robust Internal Model Control System, Design Examples, The Pseudo-Quantitative Feedback System

Learning and Teaching Strategies	
Strategies	- Active learning: Encourage students to actively engage with the course material through activities such as discussions, group work, case studies, and problem-solving exercises. This helps students to construct their own understanding of the subject matter and promotes critical thinking skills. - Real-world applications: Connect the course material to real-world examples and applications to help students see the relevance and practicality of what they are learning. This can be done through case studies, field trips, or project-based assignments. - Technology integration: Utilize technology tools and resources to enhance learning experiences. This can include multimedia presentations, online discussion forums, virtual labs, interactive simulations, and educational apps. Technology can facilitate active learning, provide additional resources, and enable collaboration among students. - Differentiation: Recognize and accommodate the diverse learning needs and preferences of students. Offer a variety of instructional approaches, such as visual, auditory, and kinesthetic activities, to cater to different learning styles. Provide additional support or challenges based on individual student needs. - Formative assessment: Incorporate ongoing formative assessments throughout the course to monitor student progress and provide timely feedback. This can include quizzes, short assignments, class discussions, or group presentations. Formative assessments help identify areas where students may need additional support and allow for course adjustments as needed. - Break down complex concepts into smaller, manageable parts and provide support and guidance as students build their knowledge and skills. - Collaborative learning: Foster a collaborative and inclusive learning environment where students can learn from and with each other. Encourage group work, peer feedback, and discussions to promote active engagement, teamwork, and the exchange of ideas. - Reflection and metacognition: Incorporate opportunities for students to reflect on their learning and develop metacognitive skills. Encourage self-assessment, journaling, or class discussions where students can analyze their learning process, identify strengths and weaknesses, and set goals for improvement.

	- Flexibility and adaptability: Recognize that students have different learning paces and preferences. Provide flexibility in terms of pacing, content delivery, and assessment methods to accommodate diverse learning needs and promote student engagement. - Continuous improvement: Regularly evaluate the effectiveness of teaching strategies and make adjustments based on student feedback, assessment results, and your own observations. Reflect on the outcomes of the course and seek opportunities for improvement in future iterations.

Student Workload (SWL)			
Structured SWL (h/sem)	48	**Structured SWL (h/w)**	3
Unstructured SWL (h/sem)	52	**Unstructured SWL (h/w)**	3.7
Total SWL (h/sem)	**100**		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**FREQUENCY RESPONSE TECHNIQUES** - Introduction - Asymptotic Approximations: Bode Plots - Introduction to the Nyquist Criterion - Sketching the Nyquist Diagram
Week 2	**FREQUENCY RESPONSE TECHNIQUES**

	- Gain Margin and Phase Margin via the Nyquist Diagram - Stability, Gain Margin, and Phase Margin via Bode Plots
Week 3	**FREQUENCY RESPONSE TECHNIQUES** - Stability via the Nyquist Diagram - Relation Between Closed-Loop Transient and Closed-Loop Frequency Responses - Relation Between Closed- and Open-Loop Frequency Responses - Relation Between Closed-Loop Transient and Open-Loop Frequency Responses - Steady-State Error Characteristics from Frequency Response - Systems with Time Delay
Week 4	**DESIGN VIA FREQUENCY RESPONSE** - Transient Response via Gain Adjustment, - Lag Compensation - Lead Compensation - Lag-Lead Compensation
Week 5	**STATE SPACE ANALYSIS** - Introduction, Some Observations, - The General State-Space Representation, - Applying the State-Space Representation,
Week 6	**STATE SPACE ANALYSIS** - Converting a Transfer Function to State Space - Converting from State Space to a Transfer Function - Linearization
Week 7	**Mid Term**
Week 8	**DESIGN VIA STATE SPACE** - Introduction - Controller Design - Controllability - Alternative Approaches to - Controller Design
Week 9	**DESIGN VIA STATE SPACE** - Observer Design - Observability - Alternative Approaches to - Observer Design - Steady-State Error Design via Integral Control
Week 10	**PID Control Design** - Introduction - Ziegler–Nichols Rules for Tuning PID Controllers - Design of PID,
Week 11	**PID Control Design** - Controllers with Frequency-Response Approach Design of PID Controllers with Computational Optimization Approach - Modifications of PID Control Schemes
Week 12	**PID Control Design** - Two-Degrees-of-Freedom Control - Zero-Placement Approach to Improve Response Characteristics

Week 13	**Robust Control Systems** - Introduction - Robust Control Systems and System Sensitivity - Analysis of Robustness
Week 14	**Robust Control Systems** - Systems with Uncertain Parameters - The Design of Robust Control Systems - The Design of Robust PID-Controlled Systems
Week 15	**Robust Control Systems** - The Robust Internal Model Control System - Design Examples - The Pseudo-Quantitative Feedback System
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	1- CONTROL SYSTEMS ENGINEERING BY NORMAN S. NISE 2- K. OGATA, MODERN CONTROL ENGINEERING,5TH EDITION	Yes
Recommended Texts	Modern Control Systems (Richard C. Dorf & Robert H. Bishop)	Yes
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

Module Information					
Module Title	Power System Analysis I		**Module Delivery**		
Module Type	Core		√Theory √Lecture ☐Lab √Tutorial ☐Practical ☐Seminar		
Module Code	EL411				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	4		**Semester of Delivery**	7	
Administering Department	Electrical Dep.		**College**	Engineering	
Module Leader	Ahme Raisan Hussein		**e-mail**	Alhusseinahmed70@uomisan.eu.iq	
Module Leader's Acad. Title	Assist. Prof		**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	01/06/2023		**Version Number**	1.0	

Relation with other Modules			
Prerequisite module	EL321 Electrical Power II	**Semester**	6
Co-requisites module		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1- To learn and study the conversion of real values in electrical networks into a perunit value. 2-To the formation of Ybus & Zbus. 3-To analyze a network under both balanced and unbalanced fault conditions and interpret the results. 4- To understand the study of power flow and load flow method 5-To develop the knowledge of power system stability involving two machine systems.
Module Learning Outcomes	1. Learn how to convert real values in electrical networks into per-unit values 2. Identify the solution using matrices Z bus and Y bus. 3. List the different terms associated with detailing electrical networks and their components. 4. Summarize what is meant by electrical faults in networks. 5. Discuss the types of faults that occur in electrical networks. 6. Description of balanced and unbalanced faults. 7. Determine how to calculate the fault current in both cases. 8. Learn how to calculate the load flow. 9. Discuss the operations of calculating the load flow by numerical methods. 10. Discuss the different characteristics of the Newton- Raphson method and Gauss-Seidel method. 11. Explain the stability system in electrical networks. 12. Identify the oscillation equation in calculating stability 13 Clarify the equal areas method and find the critical removal angle and the critical removal time 14 Explanation of stability in multiple machines. 15. Learn about transient stability software and design methods to improve transient stability.
Indicative Contents	Indicative content includes the following. Part A – Fault analysis Per-Unit Systems and Node equations, synchronous machines in power plant. The process of converting values in electrical networks into values relative to the per-unit values is illustrated with an explanation of how to solve node equations by matrix methods [12 hrs] Fault Calculations

	Symmetrical three-phase faults, symmetrical components (symmetrical components of unsymmetrical phasors, power in terms of symmetrical components, sequence impedance of sequence networks, +ve, -ve, and zero sequence networks, unsymmetrical faults on power systems. [20 hrs] Revision problem classes [5 hrs] <u>Part B – Load flow and stability</u> Load Flow Solutions Gauss-Seidel method, Newton- Raphson method, data for load flow studies, practical power flow problems utilizing computer algorithms.. [12 hrs] Power System Stability ,Stability problem, dynamics of synchronous machines, swing equation, power angle equation, steady state stability, transient stability, equal area criterion, numerical solution of swing equation, multi-machine stability, computer program of transient stability, design methods for improving transient stability. Effect of fault on stability, Stability study of typical Power systems. [14 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy of this course is based on understanding electrical networks and their components and how to maintain them through understanding the diagnosis of faults in the network, calculating the load flow, how to maintain the stability of the network, the process of removing faults as soon as possible, and encouraging students to participate in exercises, while improving and expanding critical thinking skills at the same time the time. This will be achieved through classes and interactive tutorials and by looking at simple types of experiments that include some hands-on activities.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	62	**Unstructured SWL (h/w)**	4
Total SWL (h/sem)	**125**		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	An introduction to the power system and its components and how to convert values into per-units.
Week 2	Methods for solving node equations using matrices Z bus and Y bus .
Week 3	Solving exercises on topics with a quiz exam
Week 4	Explain the types of faults that occur in electrical networks and how to calculate the fault current
Week 5	Three-phase faults or the so-called balanced faults The process of selecting circuit breakers
Week 6	symmetrical components (symmetrical components of unsymmetrical phasors, power in terms of symmetrical components
Week 7	Mid- term Exam+ sequence impedance of sequence networks, +ve, -ve, and zero sequence networks,
Week 8	unsymmetrical faults on power systems, L- G , L-L, L-L-G, faults and open conductor fault
Week 9	An introduction to the load flow and types of bus bar in electrical networks
Week 10	Gauss-Seidel method for load flow studies + quiz exam
Week 11	Newton-Raphson method, data for load flow studies, practical power flow problems utilizing computer algorithms
Week 12	Power System Stability, Stability problem, dynamics of synchronous machines.
Week 13	Swing equation, power angle equation, steady state stability, transient stability.
Week 14	Equal area criterion, numerical solution of swing equation, multi-machine stability.
Week 15	computer program of transient stability, design methods for improving transient stability. Effect of fault on stability + quiz exam.
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Power System Analysis by Hadi Saadat, 2nd Edition	
Recommended Texts	Power System Analysis by John J. Grainger and William D. Stevenson	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 FORM

Module Information					
Module Title	**Power Electronics**		**Module Delivery**		
Module Type	**Core**		☒Theory ☐Lecture ☒ Lab ☒Tutorial ☐Practical ☐Seminar		
Module Code	**EL412**				
ECTS Credits	**6**				
SWL (hr/sem)	150				
Module Level	**4**		**Semester of Delivery**		**Seven**
Administering Department	Electrical Dep		**College**	Engineering	
Module Leader	**Mohammed Kh. AL-Nussairi**		**e-mail**	E-mail:muhammed.kh@uomisan.edu.iq	
Module Leader's Acad. Title	Associate Professor		**Module Leader's Qualification**		**Ph.D.**
Module Tutor	**Mohammed Kh. AL-Nussairi**		**e-mail**	E-mail:muhammed.kh@uomisan.edu.iq	
Peer Reviewer Name	Name		**e-mail**	E-mail	
Scientific Committee Approval Date	01/06/2023		**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	155. To understand and acquire knowledge about various power semiconductor devices. 156. To familiarize students to the principle of operation, design and synthesis of different power conversion circuits and their applications. 157. To prepare the students to analyze and design different power converter circuits. 158. To provide strong foundation for further study of power electronic circuits and systems.
Module Learning Outcomes	The students, after the completion of the course, are expected to 163. Acquire knowledge about fundamental concepts and techniques used in power electronics. 164. Analyze single phase controlled converters and their performance parameters. 165. Ability to analyze various single phase and three phase power converter circuits and understand their applications. 166. Develop basic topologies of DC - DC switching regulators. 167. Explain the operation of inverters and AC to AC converters. 168. Foster ability to identify basic requirements for power electronics based design application. 169. To develop skills to build, and troubleshoot power electronics circuits. 170. Foster ability to understand the use of power converters in commercial and industrial applications..
Indicative Contents	Indicative content includes the following. Part A: introduction Principle devices and characteristics: diode, power transistor, thyristor (SCR), GTO and triac, SCR dynamic properties at switching ON and OFF. Methods of SCR turning ON, turning OFF and protection, trigger circuit design, series and parallel operation of SCR, cooling. Part B: Rectifiers Uncontrolled, half and full controlled, half and full wave rectifiers, single phase half wave, biphase, bridge, 3-phase half wave and bridge, and p-pulse rectifiers, effects of FWD, Specifications of devices and transformers. Part C: Converter Operation Overlap, principls,2 pulse, 3 pulse, p pulse and bridge converters, FWD overlap, power factor and effects of overlap, regulation, inversion and delay angle control. Part D: DC Line Commutation and Choppers Inverter classifications, forced commutations and parallel capacitors, step down choppers, step up choppers.

	<u>Part E: Inverters</u> Analysis of single-phase bridge and center tapped source inverters, square and quasi-square wave output, operation of 3-phase bridge inverter, square and quasi-square wave output, inverter voltage and frequency control technique. <u>Part F: Cyclo-converters</u> Principles, circulating currents and blocked group operations, types and applications. <u>Part G: Single Phase AC Voltage Controllers</u> AC regulators, transformer tap changers, control of multi-winding transformers, integral cycle control.

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 types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	**94**	**Structured SWL (h/w)**	**6**
Unstructured SWL (h/sem)	**56**	**Unstructured SWL (h/w)**	**4**
Total SWL (h/sem)	**150**		

Module Evaluation					
		Time/Number	Weight (Marks)	Week Due	Relevant Learning Outcome
Formative assessment	Quizzes	3	20% (20)	4,9 and 12	LO #1, #2 and #10, #11
	Assignments	1	10% (10)	13	LO #3, #4 and #6, #7
	Projects / Lab.	1	10% (10)	Continuous	All
	Report		10% (10)	13	LO #5, #8 and #10
Summative assessment	Midterm Exam	1.5hr.	10% (10)	7	LO -#7
	Final Exam	4hr	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Principle devices and characteristics: diode, power transistor, thyristor (SCR), GTO and triac, SCR dynamic properties at switching ON and OFF.
Week 2	Methods of SCR turning ON, turning OFF and protection, trigger circuit design, series and parallel operation of SCR, cooling.
Week 3	Uncontrolled, half and full controlled, half and full wave rectifiers
Week 4	single phase half wave, biphase, bridge 3-phase half wave and bridge
Week 5	P-pulse rectifiers, effects of FWD
Week 6	Specifications of devices and transformers
Week 7	Overlap, principls,2 pulse, 3 pulse, p pulse and bridge converters, FWD overlap
Week 8	Mid-term
Week 9	Power factor and effects of overlap, regulation, inversion and delay angle control.
Week 10	Inverter classifications, forced commutations and parallel capacitors
Week 11	Step down choppers, step up chopper
Week 12	Analysis of single-phase bridge and center tapped source inverters, square and quasi-square wave output
Week 13	Operation of 3-phase bridge inverter, square and quasi-square wave output, inverter voltage and frequency control technique.
Week 14	Cyclo-converters: Principles, circulating currents and blocked group operations, types and applications.

Week 15	**AC regulators, transformer tap changers, control of multi-winding transformers, integral cycle control.**
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	**Single phase half, full wave uncontrolled rectifier**
Week 2	**Three phase half, full wave uncontrolled rectifier**
Week 3	**Three phase half, full wave controlled rectifier**
Week 4	**Buck and Boost converter**
Week 5	**PWM wave and square wave voltage inverter**
Week 6	**Single phase cyclo converter**
Week 7	**Single phase AC control**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Power Electronics by P.S. Bhimra, Khanna Publishers.	
Recommended Texts	Power Electronics by M.H. Rashid, PHI. Power Electronics by M.D. Singh and K.B. Khanchandani, TMH.	
Websites	https://www.coursera.org/specializations/power-electronics	

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

Module Information				
Module Title	Information Theory		**Module Delivery**	
Module Type	Core		☒Theory ☐Lecture ☐Lab ☐Tutorial ☐Practical ☐Seminar	
Module Code	**EL413**			
ECTS Credits	5			
SWL (hr/sem)	125			
Module Level	**4**		**Semester of Delivery**	7
Administering Department	Electrical Dep.		**College**	Engineering
Module Leader	Dr. Hasanain A. Hasan		**e-mail**	Dr-hasanain@uomisan.edu.iq
Module Leader's Acad. Title	Associate Professor		**Module Leader's Qualification**	Ph.D.
Module Tutor	Dr. Hasanain A. Hasan		**e-mail**	Dr-hasanain@uomisan.edu.iq
Peer Reviewer Name	Name		**e-mail**	E-mail
Scientific Committee Approval Date	01/06/2023		**Version Number**	1.0

Relation with other Modules			
Prerequisite module	Communication systems	**Semester**	5
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	159. To give students an overview of information theory. 160. To understand the basic of coding theory. 161. To teach students the methods of source coding and channel coding. 162. This is the advanced subject for communication theory. 163. To give students all what they need to detect error in digital signals.
Module Learning Outcomes	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 171. Understand Shannon theory. 172. Do all math that related with source and channel coding. 173. Summarize what is meant by a coding. 174. Discuss the importance of Entropy. 175. Recognize the theorems of probability related with IT. 176. Define Coding. 177. Do the design of communication systems considering the IT. 178. Explain the different methods of coding.
Indicative Contents	Indicative content includes the following. Part A – Information Theory Shannon theorem, Self-information, source entropy and source entropy rate, mutual information, Channel models, condition entropies, capacity and effeincy of symmetric and non-symmetric discrete channel. [25 hrs] Part B – Coding of Discrete sources Efficiency and redundancy of code, fixed length codes, variable length code, fano code, Huffman code, Shannon code, nonbinary source coding, source extension for higher order coding efficiency . [35 hrs]. Part C – Channel coding Even and odd parity error detection codes, probability of undetected errors. Error correction codes, linear block codes (generator and parity check matrices), hamming distance, hamming weight, hamming bound and error correction capabilities. Decoding of linear block codes(syndromes). Cyclic codes: generator polynomial, nonsymmetrical code(multiplication), symmetric cyclic code (division) and realizing logic circuit for encoding and decoding. Convolutional codes, encoding logic, tree diagram, state diagram, trellis diagram. Decoding of convolutional code [65 hrs].

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 types of simple problems involving some activities that are interesting to the students. The lectures provide the students with the explanation of the core materials in the course. Students are expected to attend all lectures, tutorials, and mid-semester exams in order to maximize learning.

Student Workload (SWL)			
Structured SWL (h/sem)	62	**Structured SWL (h/w)**	3
Unstructured SWL (h/sem)	63	**Unstructured SWL (h/w)**	2
Total SWL (h/sem)	**125**		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Information theory
Week 2	Probability and Entropy
Week 3	Channel models
Week 4	Source coding
Week 5	Source coding
Week 6	Channel coding – Introduction
Week 7	Linear block codes
Week 8	hamming distance, hamming weight, hamming bound
Week 9	Mid –term exam
Week 10	Decoding of linear block codes
Week 11	Cyclic code symmetric
Week 12	Cyclic code non symmetric
Week 13	Decoding of cyclic code
Week 14	Convolutional coding
Week 15	Convolutional coding- Decoding
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Lathi, B. P. (1995). *Modern digital and analog communication systems*. Oxford University Press, Inc..	Yes
Recommended Texts	1-Communication Systems, S. Haykin, John Willy & Sons. 2- Bateman, A. (1999). *Digital Communications: Design for the real world*. Addison-Wesley. 3- Stremler, F. G. (1990). *Introduction to communication systems*.	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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="2">Engineering Control III</td><td colspan="3">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="2">C</td><td colspan="3" rowspan="4">☒Theory
☒Lecture
☐Lab
☒Tutorial
☐Practical
☒Seminar</td></tr>
<tr><td>Module Code</td><td colspan="2">EL414</td></tr>
<tr><td>ECTS Credits</td><td colspan="2">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="2">125</td></tr>
<tr><td colspan="2">Module Level</td><td>4</td><td colspan="2">Semester of Delivery</td><td>7</td></tr>
<tr><td colspan="2">Administering Department</td><td>Electrical Dep.</td><td>College</td><td colspan="2">Engineering</td></tr>
<tr><td>Module Leader</td><td colspan="2">Name</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Module Leader's Acad. Title</td><td>Professor</td><td colspan="2">Module Leader's Qualification</td><td>Ph.D.</td></tr>
<tr><td>Module Tutor</td><td colspan="2">Name (if available)</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Name</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Scientific Committee Approval Date</td><td>01/06/2023</td><td>Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>Control II</td><td>Semester</td><td>6</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. To understand the state-of-the-art of digital control systems. 2. To understand the background of digital control systems. 3. To raise critical awareness of the performance of digital control systems. 4. To develop the skills required to develop digital control systems. 5. To gain hands-on experiences through learning, applying and implementing digital control systems.
Module Learning Outcomes	179. Recognize the difference between the digital control system and classical control system. 180. Address how analysis the digital control system 181. Discuss the state of digital control system. 182. Define the optimal control system 183. Describe the types of optimal control system. 184. Enhance the performance of digital control system in various methods.
Indicative Contents	1-DESIGN IN DISCRETE DOMAIN: Shanno's sampling theorem, ideal sampling. Sample and Hold-Digital equivalents, stability in the Z-plane, -Impulse and step invariant transformations Methods of discretization - Effect of sampling- Direct discrete design – discrete root locus, digital compensator design. Design examples [30 hrs.] 2-DISCRETE STATE VARIABLE DESIGN: Discrete pole placement- state and output feedback-estimated state feedback-discrete optimal control- dynamic programming-Design examples [20 hrs.] 3-Optimal and Robust Control System Design: Review of optimal control, the linear quadratic regulator, the Kalman filter, robust control, H2 and H∞ optimal control, robust stability and robust performance, multivariable robust control. Liapunov Stability analysis, Liapunov Stability analysis of LTI systems, Model reference control systems, quadratic optimal control [30 hrs.] 4-non-linear systems: Common physical nonlinearities, the phase plane methods, Singular points, stability of nonlinear systems, Construction of phase trajectories. [20 hrs.] 5-The describing function methods: Basic concepts, derivation of describing functions for common non linearity's, stability analysis by Describing function approach, Jump resonance, Lyapunov stability criterion. [25 hrs.]

Learning and Teaching Strategies	
Strategies	Type something like: 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. In addition, seminar class will be added to improve the self-learning.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4.2
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**		10% (10)	5 and 10	LO #1, #2 and #10, #11
	Assignments		10% (10)	2 and 12	LO #3, #4 and #6, #7
	Projects / Lab.		10% (10)	Continuous	All
	Report		10% (10)	13	LO #5, #8 and #10
Summative assessment	**Midterm Exam**		10% (10)	7	LO #1 - #7
	Final Exam		50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Shanno's sampling theorem, ideal sampling, Sample and Hold-Digital equivalents
Week 2	Stability in the Z-plane, discrete root locus
Week 3	Digital compensator design
Week 4	Discrete pole placement- state and output feedback-estimated state feedback-discrete
Week 5	Optimal control- dynamic programming
Week 6	Review of optimal control, the linear quadratic regulator.
Week 7	Mid- term + The Kalman filter, robust control, H2 and H∞ optimal control
Week 8	Robust stability and robust performance, multivariable robust control
Week 9	Liapunov Stability analysis, Liapunov Stability analysis of LTI systems,
Week 10	Model reference control systems, quadratic optimal control
Week 11	Common physical nonlinearities, the phase plane methods,
Week 12	Singular points, stability of nonlinear systems, Construction of phase trajectories.
Week 13	Basic concepts, derivation of describing functions for common non linearity's stability
Week 14	Describing function approach, Jump resonance.
Week 15	Lyapunov stability criterion.
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	ESSENTIAL READING 1. S. Roland; “Advanced Control Engineering”. Elsevier, 2001.	
Recommended Texts	RECOMMENDED READING 1. K. Ogata; “Modern Control Engineering”, Prentice Hall, 2009.	
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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Antenna and Wave propagation</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">Elective</td><td colspan="2" rowspan="4">☒Theory
☐Lecture
☒Lab
☐Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">EL415</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">4</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">100</td></tr>
<tr><td colspan="2">Module Level</td><td>4</td><td colspan="2">Semester of Delivery</td><td>7</td></tr>
<tr><td colspan="2">Administering Department</td><td>Electrical Dep.</td><td>College</td><td colspan="2">Engineering</td></tr>
<tr><td>Module Leader</td><td colspan="2">Dr. Hasanain A. Hasan</td><td>e-mail</td><td colspan="2">Dr-hasanain@uomisan.edu.iq</td></tr>
<tr><td colspan="2">Module Leader’s Acad. Title</td><td>Associate Professor</td><td colspan="2">Module Leader’s Qualification</td><td>Ph.D.</td></tr>
<tr><td>Module Tutor</td><td colspan="2">Dr. Hasanain A. Hasan</td><td>e-mail</td><td colspan="2">Dr-hasanain@uomisan.edu.iq</td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Name</td><td>e-mail</td><td colspan="2">E-mail</td></tr>
<tr><td colspan="2">Scientific Committee Approval Date</td><td>01/06/2023</td><td colspan="2">Version Number</td><td>1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>Electromagnetics fields</td><td>Semester</td><td>4</td></tr>
<tr><td>Co-requisites module</td><td>Communication II</td><td>Semester</td><td>6</td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	164. To give students an overview of up to date Waves. 165. To understand the basic of Wave propagation . 166. To teach students the methods of Antenna design. 167. To deliver the basics of Antenna Engineering. 168. To give students all what they need to know about Signal propgation.
Module Learning Outcomes	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 185. Understand Antenna Concept. 186. Discuss the different kinds of Antenna Design. 187. Summarize what is meant by a Wave Propagation. 188. Discuss the importance of Different types of propagation. 189. Recognize the theorems of Wave propagation. 190. Define the Antennas required to wireless Communications.
Indicative Contents	Indicative content includes the following. Part A – Antenna Basics Antenna Basics: Introduction. Basic Antenna Parameters - Patterns, Beam Area, Radiation Intensity. Beam Efficiency, Directivity-Gain-Resolution, Antenna Apertures. Effective Height. Illustrative Problems. Fields from Oscillating Dipole. Field Zones. Shape-Impedance Considerations. Antenna Temperature. Front - to-back Ratio. Antenna Theorems. Radiation- Basic Maxwell's Equations, Retarded Potentials – Helmholtz Theorem. [30 hrs] Part B – Thin Linear Wire and UHF,VHF Antennas Radiation from Small Electric Dipole, QuarterWave Monopole and Half Wave Dipole - Current Distributions. FieldComponents. Radiated Power, Radiation Resistance, Beam Width,Directivity, Effective Area and Effective Height, Natural CurrentDistributions, Far Fields and Patterns of Thin Linear Centre-fed Antennasof Different Lengths. VHF, UHF and Microwave Antennas - I : Arrays with Parasitic Elements.Yagi-Uda Array. Folded Dipoles and their Characteristics. Helical Antennas- Helical Geometry, Helix Modes, Practical Design Considerations for Monofilar Helical Antenna in Axial and Normal Modes. Horn Antennas -Types, Fermat's Principle. Optimum Horns. Design Considerations ofPyramidal Horns, Illustrative Problems. . [30 hrs]. Part C – Wave Propagation Introduction, Definitions, Categorizations andGeneral Classifications, Different Modes of Wave Propagation, Ray/ModeConcepts. Ground Wave Propagation (Qualitative Treatment) -Introduction. Plane Earth Reflections, Space and Surface Waves, WaveTilt, Curved Earth Reflections. Space Wave Propagation - Introduction,Field Strength Variation with Distance and Height. Effect of Earth'sCurvature, Absorption. Super Refraction, M-Curves and Duct Propagation,Scattering Phenomena.

	Tropospheric Propagation, Fading and Path Loss, Sky Wave Propagation - Introduction, Structure ofIonosphere, Refraction and Reflection of Sky Waves by Ionosphere. [40 hrs]

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 types of simple problems involving some activities that are interesting to the students. The lectures provide the students with the explanation of the core materials in the course. Students are expected to attend all lectures, tutorials, and mid-semester exams in order to maximize learning.

Student Workload (SWL)			
Structured SWL (h/sem)	37	**Structured SWL (h/w)**	2.4
Unstructured SWL (h/sem)	63	**Unstructured SWL (h/w)**	4.2
Total SWL (h/sem)	**100**		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Antenna
Week 2	Basic Antenna Parameters
Week 3	Fields of Antenna and impedance consideration
Week 4	The Radiation
Week 5	Thin Linear Wire- Basics
Week 6	Thin Linear Wire- Advance concepts
Week 7	VHF, UHF and Microwave Antennas
Week 8	VHF, UHF and Microwave Antennas
Week 9	Mid –term exam
Week 10	Introduction to Wave propagation
Week 11	Modes of propagation
Week 12	Effect of Earth'sCurvature, Absorption
Week 13	Super Refraction, M-Curves and Duct Propagation,Scattering Phenomena
Week 14	Tropospheric Propagation, Fading and Path Loss
Week 15	Sky wave propagation
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Antenna Theory - C.A. Balanis, John Wiley & Sons, 3rd ed.. 2005.	Yes
Recommended Texts	1. Antennas and Wave Propagation - J.D. Kraus, RJ. Marhefka and AhmadS. Khan. TMH, New Delhi, 4'h ed., (Special Indian Edition), 2010. 2. Electromagnetic Waves and Radiating Systems - E.C. Jordan and K.G.Bahrain. PHI, 2nd e d., 2000.	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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Engineering Project and research methodology</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">CORE</td><td colspan="2" rowspan="4">☒Theory
☐Lecture
☐Lab
☐Tutorial
☒Practical
☒Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">EE416</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">4</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">100</td></tr>
<tr><td>Module Level</td><td>4</td><td colspan="2">Semester of Delivery</td><td colspan="2">Seven</td></tr>
<tr><td>Administering Department</td><td>Electrical Dep.</td><td>College</td><td colspan="3">Engineering</td></tr>
<tr><td>Module Leader</td><td>Name</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Professor</td><td colspan="2">Module Leader’s Qualification</td><td colspan="2">Ph.D.</td></tr>
<tr><td>Module Tutor</td><td>Name (if available)</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Peer Reviewer Name</td><td>Name</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Scientific Committee Approval Date</td><td>01/06/2023</td><td colspan="2">Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. Overview of Research and its Methodologies Concepts of research, The need for research , Types of research , Steps in conducting research 2. 2- Literature review, What is literature review?, Why the need for literature review?, How to carry out a literature review? 3. Selecting and defining a research problem. Problem formulation – why the need for this? What are the criteria for selecting a problem? Identifying variables, Evaluating problems, Functions of a hypothesis. 4. Conducting the research. Research activities, Preparations before conducting your research 5. Examples of Research at the University. Differences among Postgraduate and Undergraduate Research, Research at the postgraduate level (PhD and M.Sc.), Research at the undergraduate level (B.Sc.), Preparations for an Undergraduate Final Year Project 6. To impart the practical knowledge to the students and to make them to carry out the technical procedures in their project work. 7. To provide an exposure to the students to refer, read and review the research articles, journals and conference proceedings relevant to their project work and placing this as their beginning stage for their final presentation. 8. Work effectively in a group on the completion of a small-scale technical project. 9. This enables and strengthens the students to carry out the project on their own and to implement their innovative ideas to forefront the risk issues and to retrieve the hazards by adopting suitable assessment methodologies and stating it to global. 10. To guide the students such a way that the they carry out a comprehensive work on the chosen topic which will stand them in good stead as they face real life situations.
Module Learning Outcomes	1. Possesses the theoretical and practical knowledge required in Electrical Engineering discipline. 2. Utilizes his/her theoretical and practical knowledge in the fields of mathematics, science and electrical engineering towards finding engineering solutions. 3. Determines and defines a problem in electrical engineering, then models and solves it by applying the appropriate analytical or numerical methods. 4. Designs a system under realistic constraints using modern methods and tools. 5. Designs and performs an experiment, analyzes and interprets the results. 6. Possesses the necessary qualifications to carry out interdisciplinary work either individually or as a team member. 7. Accesses information, performs literature search, uses databases and other knowledge sources, and follows developments in science and technology. 8. Performs project planning and time management, plans his/her career development. 9. Possesses an advanced level of expertise in computer hardware and software, is proficient in using information and communication technologies. 10. Is competent in oral or written communication; has advanced command of English.
Indicative Contents	**Indicative content includes the following.** The students have various aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute.

	It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments. The project assignment can be individual assignment or a group assignment. There should not be more than 2 students if the project work is given to a group. The students should identify or given project assignment at least two to three months in advance. Every student has to identify the project supervisor (guide) based on their thrust area of research. He/She has to give the objectives of the project work and the detailed work plan. The project evaluation committee will approve the project topic. The committee will assess/review the work done by them by conducting periodical reviews. He/She has to submit a project report at the end of the semester. The grades will be awarded based on their performance in the internal reviews and the viva voce exam conducted at the end of the semester. Project shall be assigned to students at the start of seventh semester. The project should be based on latest technology as far as possible and it may be hardware or/and software based. The assessment of performance of students should be made at least twice in the semester. Students should be encouraged to present their progress of project using overhead projector. Each project will cover all the aspects (to the extent possible) like investigation, planning, designing, fabrication, trouble shooting and estimating of an Electrical Engineering based work. Alternately, a few research problems also may be identified for investigation and the use of laboratory facilities fully may be taken as a project work. The project shall be driven by realistic constraints like that related to economic, Environmental, social, political, ethical, health & safety, manufacturability and sustainability. The outcomes to be attained by students by doing the project work shall be spelt out clearly. A project report is to be submitted on the topic, which will be evaluated during the final review. Assessment procedure will be as spelt out in the regulations. Usually the student has to continue the work carried out in seventh semester. The student's performance will be evaluated by conducting periodical reviews by the committee members nominated by the head of the department. The end semester examination will be conducted by Examiners.

Learning and Teaching Strategies	
Strategies	Lecture, Discussion, Question and Answer, Observation, Field Trip, Team/Group Work, Preparing and/or Presenting Reports, Experiment, Drill and Practice, Case Study, Problem Solving, Brain Storming, Project Design/Management.

Student Workload (SWL)			
Structured SWL (h/sem)	**48**	**Structured SWL (h/w)**	3.2
Unstructured SWL (h/sem)	**52**	**Unstructured SWL (h/w)**	3.46
Total SWL (h/sem)	**100**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative Assessment	**Projects**	1	35% (35)	Continuous	All
Summative assessment	**Exam**	2	15% (15)	16- seventh semester	LO #1 - #7
	Final Exam	3	50% (50)	16- Eighth semester	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	PROJECT WORK + 1 hr research methodology
Week 2	PROJECT WORK + 1 hr research methodology
Week 3	PROJECT WORK + 1 hr research methodology
Week 4	PROJECT WORK + 1 hr research methodology
Week 5	PROJECT WORK + 1 hr research methodology
Week 6	PROJECT WORK + 1 hr research methodology
Week 7	PROJECT WORK + 1 hr research methodology
Week 8	PROJECT WORK + 1 hr research methodology
Week 9	PROJECT WORK + 1 hr research methodology
Week 10	PROJECT WORK + 1 hr research methodology
Week 11	PROJECT WORK + 1 hr research methodology
Week 12	PROJECT WORK + 1 hr research methodology
Week 13	PROJECT WORK + 1 hr research methodology
Week 14	PROJECT WORK + 1 hr research methodology
Week 15	PROJECT WORK + 1 hr research methodology
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Determined by the faculty member in charge and the student.	YES
Recommended Texts	Determined by the faculty member in charge and the student.	YES
Websites	Determined by the faculty member in charge and the student.	

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

Module Information					
Module Title	Power System AnalysisII		**Module Delivery**		
Module Type	Core		√Theory √Lecture ☐Lab √Tutorial ☐Practical ☐Seminar		
Module Code	EL421				
ECTS Credits	5				
SWL (hr/sem)	125				
Module Level	4		**Semester of Delivery**	8	
Administering Department	Electrical Dep.		**College**	Engineering	
Module Leader	Ahme Raisan Hussein		**e-mail**	Alhusseinahmed70@uomisan.eu.iq	
Module Leader's Acad. Title	Assist. Prof		**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	01/06/2023		**Version Number**	1.0	

Relation with other Modules			
Prerequisite module	EL411Power System Analysis I	**Semester**	7
Co-requisites module		**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1- To learn the student on the types of protection used in the power system. 2- To learn about relays and their types and uses. 3- To learn about the current transformers and voltage transformers used in the protection process. 4- To learn how to calculate the economic operation of power plants 5- To learn about the SCADA system and how to use it in the power system.
Module Learning Outcomes	1. Identify the protection system and its importance in the power system. 2. Understanding of the types of electrical switches and circuit breakers. 3. Learn about the development of relays, the principle of their work and their uses. 4. Understanding types of protection such as overload protection, direct protection, distance protection, and differential protection. 5. Discuss the protection of the system and protection of apparatus. 6. Description of the work of current transformers and voltage transformers. 7. Learn how to design current transformers and voltage transformers and the most important problems that may occur in them. 8. Identify power generation units and their economical operation. 9. Discussing the process of dispatch electric power and calculating its losses. 10. Learn about Penalty factor and economic power operation. 11. Discuss the effect of speed change on droop characteristics. 12. Recognize the power system control and its importance. 13 Understanding of power system operation methods main work tasks. 14 Familiarize yourself with the SCADA system, the central control system, and the subsidiary communications system. 15. Learn about the use of SCADA system in generation, transmission and distribution.
Indicative Contents	Indicative content includes the following. <u>Part A – System Protection</u> Switchgear, circuit breakers, quantities required of protection, primary and back-up protection, current transformers, voltage transformers, relays, protection system, over-current protection, over-current and directional, distance protection, unit protection, differential relaying, generator protection, transformer protection, T.L. protection, motor protection. [25 hrs] Part B – Economic dispatch Characteristics of power generation units, economic dispatch problems with and

	without consideration of losses, incremental fuel cost, penalty factor, economic power interchange. Voltage, power and frequency control. Evaluation of the effect of speed change on droop characteristics. [16 hrs] Revision problem classes [6 hrs] <u>Part C – Power System Control</u> Introduction to power system control and its importance, modes of power system operation, major tasks of operation. SCADA system, control centers, controller tuning, communication sub system, remote terminal unit, data logging. [16 hrs]

Learning and Teaching Strategies	
Strategies	The main strategy of this course is based on understanding the protection in the electrical system by identifying the types of protection used and the types of relays. The focus is also on the economical operation of electric power plants and controlling them, and getting acquainted with the SCADA system and how to use it in the power system, and encouraging students to participate in the exercises, with Improving and expanding critical thinking skills at the same time. This will be achieved through classes and interactive tutorials and by looking at simple types of experiences that include some hands-on activities.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4
Unstructured SWL (h/sem)	62	**Unstructured SWL (h/w)**	4
Total SWL (h/sem)	**125**		

Module Evaluation

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

Delivery Plan (Weekly Syllabus)

	Material Covered
Week 1	Introduction to the protection system used in the power system.
Week 2	Switchgear, circuit breakers, quantities required of protection.
Week 3	Development of relays, their uses and components.
Week 4	Over-current protection, over-current and directional, distance protection, unit protection, differential relaying.
Week 5	Apparatus protection, system protection and relays used in it+ quiz exam
Week 6	Current transformers, voltage transformers CT & VT.
Week 7	Mid- term Exam+ Design of CT and VT used in protection and solving the problem of saturation and Ferro resonance.
Week 8	Characteristics of power generation units, economic dispatch.
Week 9	Dispatch problems with and without consideration of losses, incremental fuel cost.
Week 10	Penalty factor, economic power interchange. Voltage, power and frequency control.+ quiz exam
Week 11	Evaluation of the effect of speed change on droop characteristics .
Week 12	Introduction to power system control and its importance.
Week 13	Modes of power system operation, major tasks of operation.
Week 14	SCADA system, control centers, controller tuning, communication sub system, remote terminal unit, data logging.
Week 15	Use of SCADA system in power generation, transmission and distribution system + quiz exam.
Week 16	**Preparatory week before the final Exam**

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Power system stability And control P . Kundur	
Recommended Texts	Fundamentals of Power System Economics Daniel Kirschen Goran Strbac. Power system SCADA Smart Grids by Mini S. Thomas	yes
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

Module Information					
Module Title	Special Machine		Module Delivery		
Module Type	Core		☒Theory ☐Lecture ☒ Lab ☒Tutorial ☐Practical ☒ Seminar		
Module Code	EL422				
ECTS Credits	6				
SWL (hr/sem)	150				
Module Level	4		Semester of Delivery		Eight
Administering Department	Electrical Dep.		College	Engineering	
Module Leader	Mohammed Kh. AL-Nussairi		e-mail	E-mail:muhammed.kh@uomisan.edu.iq	
Module Leader's Acad. Title	Associate Professor		Module Leader's Qualification		Ph.D.
Module Tutor	Mohammed Kh. AL-Nussairi		e-mail	E-mail:muhammed.kh@uomisan.edu.iq	
Peer Reviewer Name	Name		e-mail	E-mail	
Scientific Committee Approval Date	01/06/2023		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	169. To provide thorough knowledge in the emerging field of special electrical machines. 170. To enable the student to understand various machine made from permanent magnets and their applications. 171. Applications, which will be utilized in the electrical machines with its performance and theory of operation. 172. To develop simple mathematical model for engineering problems and carry out static analysis.
Module Learning Outcomes	The students, after the completion of the course, are expected to 191. Able to explain the control aspect of special electrical machines. 192. Able to understand the construction of special machine, different windings. 193. Able to analyze different types of special machine their characteristics, industrial applications. 194. Use phasor diagrams and performance characteristics to explain the operation of motors 195. Able to interrupt the various losses in special machine and their efficiency. 196. Foster ability to identify basic requirements for special machine based design application.
Indicative Contents	Indicative content includes the following. <u>Part A:Universal and single phase Ac commutator motor</u> Principles, torque and speed equations, small universal and large AC motors, speed changing, applications. <u>Part B: Single-Phase Repulsion Motors</u> Repulsion principles and repulsion motors, repulsion start IM, repulsion IM. <u>Part C: DC servo</u> Armature -controlled DC motors, field-controlled DC motors, motor generator transfer function, Main requirements of servos, two-phase servo motor transfer function, the IM as a servo motor, drug cup construction, introduction to tacho generators and induction tacho generators. <u>Part D: Stepper Motors</u> Permanent magnet stepper motors, variable reluctance stepper motors, torque-speed characteristics, step angle and speed. <u>Part E: Reluctance motors</u> Single and three phase reluctance motors, construction and principle of operation. <u>Part F: Linear Induction Motor</u> Construction, principle of operation, applications <u>Part G:Brushless DC Motor</u> Construction, principle of operation, types of BLDC, applications

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 types of simple experiments involving some sampling activities that are interesting to the students.

Student Workload (SWL)			
Structured SWL (h/sem)	94	**Structured SWL (h/w)**	**6**
Unstructured SWL (h/sem)	**56**	**Unstructured SWL (h/w)**	**4**
Total SWL (h/sem)	**150**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative assessment	**Quizzes**	**2**	**10% (20)**	**4,9 and 12**	**LO #1, #2 and #10, #11**
	Assignments	**1**	**10% (10)**	**13**	**LO #3, #4 and #6, #7**
	Projects / Lab.	**1**	**10% (10)**	**Continuous**	**All**
	Report	**1**	**10% (10)**	**14**	**LO #5, #8 and #10**
Summative assessment	**Midterm Exam**	**1.5hr.**	**10% (10)**	**7**	**LO -#7**
	Final Exam	**4hr**	**50% (50)**	**16**	**All**
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**Introduction to machines: Basic Concepts**
Week 2	**single phase AC commutator motor: Principles, torque and speed equations**
Week 3	**single phase AC commutator motor: speed changing, applications**
Week 4	**Universal motors: Principles, torque and speed equations, speed changing and applications**
Week 5	**Repulsion principles and repulsion motors, repulsion start IM, repulsion IM.**
Week 6	**Armature -controlled DC motors, field-controlled DC motors, motor generator transfer function**
Week 7	**Main requirements of servos, two-phase servo motor transfer function, the IM as a servo motor, drug cup construction**
Week 8	**Mid-term**
Week 9	**introduction to tacho generators and induction tacho generators**
Week 10	**Permanent magnet stepper motors, variable reluctance stepper motors**
Week 11	**torque-speed characteristics, step angle and speed of stepper motor**
Week 12	**Single and three phase reluctance motors**
Week 13	**Reluctance motors: Construction and principle of operation.**
Week 14	**Linear induction motor: Construction, principle of operation, applications**
Week 15	**Brushless DC Motor: Construction, principle of operation, types of BLDC, applications**
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Single Phase AC Commutator Motor: Modelling and Simulation
Week 2	Single Phase AC Commutator Motor: Speed-Torque Characteristics
Week 3	DC SERVO MOTOR: Modelling and Simulation
Week 4	DC SERVO MOTOR: Speed-Torque Characteristics
Week 5	Stepper Motor Control
Week 6	Brushless DC Motor: Modelling and Simulation
Week 7	Brushless DC Motor Control

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Special electrical Machines by K. Venkata Ratnam, University press, 2009, New Delhi.	
Recommended Texts	A Course in Electrical Technology by J.B.Gupta, S.K.Kataria & Sons,12th Edition Jacek F. Gieras (2008), Advancements in electric machines, Springer, Illustrated edition.	
Websites	https://www.coursera.org	

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

<table>
<tr><th colspan="5">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="2">Digital Communication</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="2">Core</td><td colspan="2" rowspan="4">☒Theory
☐Lecture
☒Lab
☐Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="2">EL423</td></tr>
<tr><td>ECTS Credits</td><td colspan="2">6</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="2">150</td></tr>
<tr><td colspan="2">Module Level</td><td>4</td><td>Semester of Delivery</td><td>8</td></tr>
<tr><td colspan="2">Administering Department</td><td>Electrical Dep.</td><td>College</td><td>Engineering</td></tr>
<tr><td>Module Leader</td><td colspan="2">Dr. Hasanain A. Hasan</td><td>e-mail</td><td>Dr-hasanain@uomisan.edu.iq</td></tr>
<tr><td colspan="2">Module Leader’s Acad. Title</td><td>Associate Professor</td><td>Module Leader’s Qualification</td><td>Ph.D.</td></tr>
<tr><td>Module Tutor</td><td colspan="2">Dr. Hasanain A. Hasan</td><td>e-mail</td><td>Dr-hasanain@uomisan.edu.iq</td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td>Name</td><td>e-mail</td><td>E-mail</td></tr>
<tr><td colspan="2">Scientific Committee Approval Date</td><td>01/06/2023</td><td>Version Number</td><td>1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>Communication systems</td><td>Semester</td><td>5</td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	173. To give students an overview of up to date theory in communication. 174. To understand the basic of Multi carrier, Spread Spectrum . 175. To teach students the methods of spread spectrum. 176. To deliver the basics of digital multiplexer. 177. To give students all what they need to know about Multi user detection.
Module Learning Outcomes	Important: Write at least 6 Learning Outcomes, better to be equal to the number of study weeks. 197. Understand Spread spectrum. 198. Discuss the digital multiplexers. 199. Summarize what is meant by a Multicarrier modulation. 200. Discuss the importance of OFDM. 201. Recognize the theorems of Multiuser detection. 202. Define equalization. 203. Do the design of advance modulation systems.
Indicative Contents	Indicative content includes the following. <u>Part A – Spread Spectrum Modulation</u> Model of spread spectrum, system generation of pseudo-noise (PN) sequence, direct sequence spread spectrum, frequency hopping spread spectrum, synchronization in spread spectrum systems, comparison of spread spectrum, applications of spread spectrum. [50 hrs] <u>Part B – Digital Multiplexers</u> Introduction to Multiplexing, a PAM/TDM system, Introduction to digital multiplexing Classification of digital Multiplexers, Multiplexing__hierarchy for digital communications, North American hierarchy, T lines, PCM-TDM system . [50 hrs]. <u>Part C – Multiuser detection and OFDM communications</u> Introduction to Multiuser detection, OFDM, Channel noise in OFDM, Zero padded OFDM system, cyclic prefix redundancy in OFDM system, OFDM equalization[50 hrs] .

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 types of simple problems involving some activities that are interesting to the students. The lectures provide the students with the explanation of the core materials in the course. Students are expected to attend all lectures, tutorials, and mid-semester exams in order to maximize learning.

Student Workload (SWL)			
Structured SWL (h/sem)	94	**Structured SWL (h/w)**	6.2
Unstructured SWL (h/sem)	56	**Unstructured SWL (h/w)**	3.7
Total SWL (h/sem)	**150**		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to digital communication
Week 2	Spread spectrum –Direct Sequence
Week 3	Spread spectrum –Frequency hopping
Week 4	synchronization in spread spectrum systems
Week 5	comparison of spread spectrum, applications of spread spectrum.
Week 6	Introduction to Multiplexing
Week 7	Multiplexing hierarchy
Week 8	T Lines
Week 9	Mid –term exam
Week 10	Introduction to Multicarrier modulation
Week 11	Introduction to OFDM modulation
Week 12	Noise in OFDM channel
Week 13	Demodulation of OFDM signal
Week 14	OFDM equalization
Week 15	Recap of all studies and application of communication systems.
Week 16	**Preparatory week before the final Exam**

Delivery Plan (Weekly Lab. Syllabus)	
	Material Covered
Week 1	Analog Modulation – AM
Week 2	Analog Modulation – PM, FM
Week 3	Digital Modulation – PAM
Week 4	Digital Modulation – ASK, FSK, PSK
Week 5	Introduction to Communication modulation using Matlab
Week 6	OFDM using Matlab
Week 7	Spread spectrum using Matlab

Learning and Teaching Resources		
	Text	**Available in the Library?**
Required Texts	Lathi, B. P. (1995). *Modern digital and analog communication systems*. Oxford University Press, Inc..	Yes
Recommended Texts	1-Communication Systems, S. Haykin, John Willy & Sons. 2- Bateman, A. (1999). *Digital Communications: Design for the real world*. Addison-Wesley. 3- Stremler, F. G. (1990). *Introduction to communication systems*.	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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Advanced Electronics</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">C</td><td colspan="2" rowspan="4">☒Theory
☒Lecture
☐Lab
☒Tutorial
☐Practical
☒Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">EL424</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">5</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">125</td></tr>
<tr><td colspan="2">Module Level</td><td>4</td><td colspan="2">Semester of Delivery</td><td>Eight</td></tr>
<tr><td colspan="2">Administering Department</td><td>Electrical Dep.</td><td>College</td><td colspan="2">Engineering</td></tr>
<tr><td>Module Leader</td><td colspan="2">Nawar Alseelawi</td><td>e-mail</td><td colspan="2">Nawar.alseelawi@uomisan.edu.iq</td></tr>
<tr><td colspan="2">Module Leader’s Acad. Title</td><td>Lecturer</td><td colspan="2">Module Leader’s Qualification</td><td>M.Sc.</td></tr>
<tr><td>Module Tutor</td><td colspan="2">Nawar Alseelawi</td><td>e-mail</td><td colspan="2">Nawar.alseelawi@uomisan.edu.iq</td></tr>
<tr><td colspan="2">Peer Reviewer Name</td><td></td><td>e-mail</td><td colspan="2"></td></tr>
<tr><td colspan="2">Scientific Committee Approval Date</td><td>01/06/2023</td><td>Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>Electronics III</td><td>Semester</td><td>Five</td></tr>
<tr><td>Co-requisites module</td><td>Electronics IV</td><td>Semester</td><td>Six</td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	178. To provide a comprehensive understanding of the different types of integrated circuits technologies, including CMOS, TTL, ECL, and E^2CMOS. The student will understand the basic operational characteristics, parameters, and practical considerations. 179. The module aims to give students a thorough understanding of signal conversion methods including analog-to-digital conversion (ADC) and digital-to-analog conversion (DAC). It will also cover the key concepts of sampling, filtering, and signal processing errors. 180. The goal is to provide a comprehensive overview of various digital storage devices such as RAM, ROM, and Flash memory. It will also cover concepts related to memory operations, organization, and types. 181. This module aims to equip students with an understanding of programmable logic devices such as SPLDs, CPLDs, and FPGAs. The students will learn about their architecture, operation, and applications. 182. The module also aims to develop practical skills through laboratory work and design projects. This will allow students to apply their theoretical knowledge to practical problems and situations. 183. The module aims to relate the concepts learned to real-world electronics applications, helping students understand how these concepts are utilized in industry. 184. To stimulate critical thinking and problem-solving skills in students, thereby enabling them to design and troubleshoot advanced electronic circuits. 185. This module also aims to prepare students for more advanced study or professional work in electronics, by providing a solid foundation in advanced electronics concepts.
Module Learning Outcomes	Upon successful completion of this module, students will be able to: 204. Integrated Circuits Technologies: Understand and compare the operational characteristics and parameters of different integrated circuits technologies such as CMOS, TTL, ECL, and E^2CMOS. 205. Signal Conversion and Processing: Demonstrate comprehensive knowledge of various methods of signal conversion including analog-to-digital conversion (ADC) and digital-to-analog conversion (DAC), as well as their associated errors. 206. Digital Storage Devices: Explain the workings of various digital storage devices such as RAM, ROM, and Flash memory, and be able to differentiate between them based on their operations and organization. 207. Programmable Logic Devices: Understand the principles of programmable logic devices including SPLDs, CPLDs, and FPGAs, and their applications in electronics. 208. Practical Skills: Apply theoretical knowledge to practical situations,

	demonstrate proficiency in laboratory work, and complete design projects related to advanced electronics. 209. Real-world Applications: Apply the concepts learned in the module to real-world electronics applications, demonstrating an understanding of their practical use in industry. 210. Critical Thinking: Demonstrate critical thinking and problem-solving skills in the design and troubleshooting of advanced electronic circuits. 211. Preparation for Further Study: Exhibit a solid foundation in advanced electronics concepts, preparing them for further study or professional work in the field of electronics.
Indicative Contents	Indicative content includes the following. **<u>Chapter One - Integrated Circuits Technologies:</u>** Fixed-Function Logic Gates, Basic Operational Characteristics and Parameters, CMOS Circuits, TTL (Bipolar) Circuits, Practical Considerations in the Use of TTL, Emitter-Coupled Logic (ECL) Circuits, PMOS, NMOS, and E^2CMOS [18 Hours] **<u>Chapter Two: Signal Conversion and Processing:</u>** Analog-to-Digital Conversion, Methods of Analog-to-Digital Conversion, Methods of Digital-to-Analog Conversion [15 Hours] **<u>Chapter Three: Digital Storage Devices:</u>** Semiconductor Memory Basics, The Random-Access Memory (RAM), The Read-Only Memory (ROM), Programmable ROM, The Flash Memory [15 Hours] **<u>Chapter Four: Programmable Logic Devices:</u>** Simple Programmable Logic Devices (SPLDs), Complex Programmable Logic Devices (CPLDs), Macrocell Modes, Field-Programmable Gate Arrays (FPGAs) [15 Hours]

Learning and Teaching Strategies	
Strategies	Learning and Teaching strategies for the Advanced Electronics module include: **1. Lectures:** Core theoretical concepts will be delivered through lectures. Lectures will also provide overviews of integrated circuit technologies, signal conversion and processing, digital storage devices, and programmable logic devices.

	2. Workshops and Tutorials: These interactive sessions will be used to work through example problems, enhance understanding of lecture materials, and discuss course topics in detail. **3. Group Projects:** Students will be assigned to small groups for project work, which encourages collaborative learning and the development of teamwork skills. Projects will involve designing and implementing circuits using various types of integrated circuits and programmable logic devices. **4. Self-Study:** Outside of scheduled classes, students are expected to undertake independent study. This will include pre-lecture reading, post-lecture follow-up work, revision, and completion of assignments. **5. Assessments:** A combination of formative and summative assessments will be used to monitor student learning. These may include laboratory reports, project reports, quizzes, and final exams. **6. Online Resources:** Relevant online resources, including tutorial videos, webinars, online readings, and quizzes will be provided to supplement the learning experience. This also allows for flexible learning at the student's own pace. **7. Guest Lectures/Seminars:** Industry experts may be invited to deliver guest lectures or seminars to provide insight into the application of advanced electronics in the real world. **8. Office Hours/Feedback Sessions:** Instructors will hold regular office hours and feedback sessions to provide individual assistance to students, address any difficulties or concerns, and offer personal feedback on students' progress.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4.2
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)	6 and 15	LO #1, #2 and #10, #11
	Assignments	3	15% (10)	3 and 7 and 12	LO #3, #4 and #6, #7
	Projects / Lab.	1	15% (15)	Continuous	All
Summative assessment	**Midterm Exam**	2 hrs.	10% (10)	9	LO #1 - #7
	Final Exam	3 hrs.	50% (50)	16	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	**<u>Chapter One: Integrated Circuits Technologies</u>** 1.1 Fixed-Function Logic Gates 1.2 Basic Operational Characteristics and Parameters 1.2.1 DC Supply Voltage 1.2.2 Logic Levels 1.2.3 Noise Immunity 1.2.4 Noise Margin 1.2.5 Power Dissipation 1.2.6 Propagation Delay Time 1.2.7 Speed-Power Product (SPP) 1.2.8 Loading and Fan-Out 1.2.8.1 CMOS Loading 1.2.8.2 TTL Loading
Week 2	1.3 CMOS Circuits 1.3.1 The MOSFET 1.3.2 CMOS Inverter 1.3.3 CMOS NAND Gate 1.3.4 CMOS NOR Gate 1.3.5 Open-Drain Gates

	1.3.6 Tri-state CMOS Gates 1.3.7 Implementing Logic in CMOS
Week 3	1.4 TTL (Bipolar) Circuits 1.4.1 The Bipolar Junction Transistor 1.4.2 TTL Inverter 1.4.3 TTL NAND Gate 1.4.4 Open-Collector Gates 1.4.5 Tri-state TTL Gates 1.4.6 Schottky TTL
Week 4	1.5 Practical Considerations in the Use of TTL 1.5.1 Current Sinking and Current Sourcing 1.5.2 Using Open-Collector Gates for Wired-AND Operation 1.5.2.1 Pull-up Resistor 1.5.3 Connection of Totem-Pole Outputs 1.5.4 Open-Collector Buffer/Drivers 1.5.5 Unused TTL Inputs 1.5.5.1 Tied-Together Inputs 1.5.5.2 Inputs to VCC or Ground 1.5.5.3 Inputs to Unused Output
Week 5	1.6 Emitter-Coupled Logic (ECL) Circuits 1.7 PMOS, NMOS, and E^2CMOS 1.7.1 PMOS 1.7.2 NMOS 1.7.3 E^2CMOS
Week 6	**Chapter Two: Signal Conversion and Processing + Quiz** 2.1 Analog-to-Digital Conversion 2.1.1 Sampling and Filtering 2.1.1.1 The Sampling Theorem 2.1.1.2 The Need for Filtering 2.1.1.3 Aliasing Concept Illustration 2.1.2 Holding the Sampled Value 2.1.3 Analog-to-Digital Conversion 2.1.3.1 Quantization Process
Week 7	2.2 Methods of Analog-to-Digital Conversion 2.2.1 Flash ADC

	2.2.2 Dual-Slope ADC 2.2.3 Successive-Approximation ADC 2.2.4 Segma-Delta ADC 2.2.5 Testing Analog-to-Digital Converters 2.2.6 Analog-to-Digital Conversion Errors 2.2.6.1 Missing Code 2.2.6.2 Incorrect Code 2.2.6.3 Offset
Week 8	2.3 Methods of Digital-to-Analog Conversion 2.3.1 Binary-Weighted-Input DAC 2.3.2 R/2R Ladder DAC
Week 9	2.3.3 Performance Characteristics of DACs 2.3.3.1 Resolution 2.3.3.2 Accuracy 2.3.3.3 Linearity 2.3.3.4 Monotonicity 2.3.3.5 Settling time 2.3.4 Digital-to-Analog Conversion Errors 2.3.4.1 Nonmonotonicity 2.3.4.2 Differential Nonlinearity 2.3.4.3 Low or High Gain 2.3.4.4 Offset Error 2.3.5 The Reconstruction Filter
Week 10	**Midterm Exam**
Week 11	**Chapter Three: Digital Storage Devices** 3.1 Semiconductor Memory Basics 3.1.1 Basic Memory Operations 3.2 The Random-Access Memory (RAM) 3.2.1 Static RAMs (SRAMs) 3.2.2 Basic Asynchronous SRAM Organization 3.2.3 Synchronous SRAM with Burst Feature 3.2.4 Cache Memory 3.2.5 Dynamic RAM (DRAM) Memory Cells 3.2.6 DRAM Organization 3.2.6.1 Address Multiplexing

	3.2.6.2 Fast Page Mode 3.2.6.3 Refresh Cycles 3.2.7 Types of DRAMs 3.2.7.1 FPM DRAM 3.2.7.2 EDO DRAM 3.2.7.3 BEDO DRAM 3.2.7.4 SDRAM 3.2.7.5 DDR SDRAM
Week 12	3.3 The Read-Only Memory (ROM) 3.3.1 The Mask ROM 3.3.2 Internal ROM Organization 3.3.3 ROM Access Time
Week 13	3.4 Programmable ROM 3.4.1 PROM 3.4.2 EPROM 3.5 The Flash Memory 3.5.1 Flash Memory Cell 3.5.2 Flash Memory Array
Week 14	**<u>Chapter Four: Programmable Logic Devices+ Quiz</u>** 4.1 Simple Programmable Logic Devices (SPLDs) 4.1.1 SPLD: The PAL 4.1.2 SPLD: The GAL 4.1.3 Simplified Notation for PAL/GAL Diagrams 4.1.4 Macrocells
Week 15	4.2 Complex Programmable Logic Devices (CPLDs) 4.2.1 Classic CPLD Architecture 4.2.1.1 Shared Expanders 4.2.1.2 Parallel Expanders 4.2.2 LUT CPLD Architecture 4.2.3 PLA (Programmable Logic Array) 4.3 Macrocell Modes 4.3.1 The Combinational Mode 4.3.2 The Registered Mode 4.4 Field-Programmable Gate Arrays (FPGAs) 4.4.1 Configurable Logic Blocks

	4.4.2 SRAM-Based FPGAs 4.4.3 FPGA Cores
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	Thomas L. Floyd, "Digital Fundamentals", 11TH Edition, Pearson Education Limited 2015.	Yes
Recommended Texts		
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

<table>
<tr><th colspan="6">Module Information</th></tr>
<tr><td>Module Title</td><td colspan="3">Renewable Energy System</td><td colspan="2">Module Delivery</td></tr>
<tr><td>Module Type</td><td colspan="3">Elective</td><td colspan="2" rowspan="4">☒Theory
☒Lecture
☐Lab
☒Tutorial
☐Practical
☐Seminar</td></tr>
<tr><td>Module Code</td><td colspan="3">EL425</td></tr>
<tr><td>ECTS Credits</td><td colspan="3">4</td></tr>
<tr><td>SWL (hr/sem)</td><td colspan="3">100</td></tr>
<tr><td>Module Level</td><td>4</td><td colspan="2">Semester of Delivery</td><td colspan="2">Eight</td></tr>
<tr><td>Administering Department</td><td>Electrical Dep.</td><td>College</td><td colspan="3">Engineering</td></tr>
<tr><td>Module Leader</td><td>Name</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Module Leader’s Acad. Title</td><td>Professor</td><td colspan="2">Module Leader’s Qualification</td><td colspan="2">Ph.D.</td></tr>
<tr><td>Module Tutor</td><td>Name (if available)</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Peer Reviewer Name</td><td>Name</td><td>e-mail</td><td colspan="3">E-mail</td></tr>
<tr><td>Scientific Committee Approval Date</td><td>01/06/2023</td><td colspan="2">Version Number</td><td colspan="2">1.0</td></tr>
</table>

<table>
<tr><th colspan="4">Relation with other Modules</th></tr>
<tr><td>Prerequisite module</td><td>None</td><td>Semester</td><td></td></tr>
<tr><td>Co-requisites module</td><td>None</td><td>Semester</td><td></td></tr>
</table>

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	1. Introduce renewable energy sources: Provide an overview of various renewable energy sources such as solar, wind, hydro, geothermal, and biomass, including their availability, characteristics, and potential for power generation. 2.Understand the principles of energy conversion: Explain the fundamental principles and mechanisms involved in the conversion of renewable energy into electricity, including photovoltaic effect, wind turbine operation, hydroelectric generation, and geothermal energy extraction. 3.Analyze renewable energy technologies: Study the different technologies and systems used for harnessing renewable energy, including solar photovoltaic (PV) systems, wind turbines, hydroelectric power plants, and geothermal power plants. Understand their working principles, components, and integration into the electrical grid. 4.Perform system modeling and analysis: Develop skills in modeling and analyzing renewable energy systems using appropriate software tools. Learn to evaluate the performance and efficiency of renewable energy systems under different operating conditions. 5.Study system integration and grid connection: Explore the challenges and considerations involved in integrating renewable energy systems with the existing electrical grid. Understand the concepts of power electronics, grid synchronization, and power quality for grid-connected renewable energy systems. 6.Assess economic and environmental aspects: Analyze the economic feasibility and environmental impact of renewable energy systems. Study factors influencing project costs, including capital investment, maintenance, and operation. Evaluate the environmental benefits and limitations of renewable energy technologies. 7.Investigate energy storage solutions: Explore different energy storage technologies and their role in renewable energy systems. Understand the importance of energy storage for grid stability, load balancing, and managing intermittent energy sources. 8.Promote sustainable development and energy transition: Foster an understanding of the role of renewable energy in achieving sustainable development goals and transitioning to a low-carbon economy. Encourage students to explore innovative approaches and emerging trends in renewable energy research and technology. 9.Recognize opportunities of employing appropriate types of renewable energy systems in different geographical locations, perform sizing studies, and propose appropriate system configuration. 10.Apply the new strategies of smart grid control and distributed generation philosophies. 11.Understand and employ the ethical responsibility for energy sustainability.
Module Learning Outcomes	Upon completing the module on Renewable Energy Systems, students should be able to: 1.Describe and explain the principles of renewable energy conversion and the operation of various renewable energy technologies, including solar photovoltaic systems, wind turbines, hydroelectric power plants, and geothermal power plants. 2.Graduates of this program will be able to perform the right analysis and measurements to discover the flues of energy systems and electrical networks, as the graduate will be qualified to suggest related improvement, in addition to generators, transformers, wind turbines, photovoltaic modules, transformers and other related equipment.

<table>
<tr><td></td><td>3.Identify and evaluate different renewable energy sources, including solar, wind, hydro, geothermal, and biomass, in terms of their availability, characteristics, and potential for power generation.
4.Analyze and compare the performance and efficiency of renewable energy systems under different operating conditions and assess their economic feasibility and environmental impact.
5.The graduate will be able to design, stimulate, analyze, and apply renewable and conventional energy systems, or even expand the current systems to meet with the market needs.
6.Apply appropriate software tools to model and analyze renewable energy systems, considering factors such as system integration, grid connection, and power quality.
7.Assess the challenges and considerations involved in integrating renewable energy systems with the existing electrical grid, including power electronics, grid synchronization, and grid stability.
8.Understand the role and importance of energy storage solutions in renewable energy systems for grid stability, load balancing, and managing intermittent energy sources.</td></tr>
<tr><td>Indicative Contents</td><td>The following indicative contents outline the topics covered in a module of Renewable Energy Systems
1. Introduction to Renewable Energy Systems
• Overview of renewable energy sources: solar, wind, hydro, geothermal, biomass
• Characteristics, availability, and potential for power generation
• Environmental and economic significance of renewable energy

2. Solar Photovoltaic Systems
• Principles of photovoltaic effect and solar cell operation
• Solar panel technologies and characteristics
• System components: modules, inverters, charge controllers, batteries
• System design and sizing considerations
• Grid integration and net metering

3. Wind Energy Conversion Systems (WECS)
• Wind turbine technologies and operation principles
• Aerodynamics of wind turbine blades
• Control systems and pitch regulation
• Grid-connected and standalone wind power systems
• Wind resource assessment and site selection

4. Hydroelectric Power Systems
• Types of hydroelectric power plants: run-of-river, reservoir, pumped storage
• Turbine types and hydropower generation principles
• Dam design and environmental considerations
• Grid synchronization and control strategies
• Small-scale hydroelectric systems</td></tr>
</table>

	5. Geothermal Energy Systems • Geothermal energy extraction techniques: dry steam, flash steam, binary cycle • Geothermal resource assessment and exploration • Geothermal power plant design and operation • Heat exchangers, turbines, and generators • Environmental impacts and mitigation measures 6. Biomass Energy Systems • Biomass as a renewable energy source: types and characteristics • Biomass conversion technologies: combustion, gasification, anaerobic digestion • Biomass power plant components and operation • Feedstock availability and sustainability • Biomass co-firing and biogas utilization 7. Power electronics for renewable energy systems • Inverters and Converters for PV energy conversion system 8. Maximum power point • Overview of maximum power point (MPP) • Maximum power point tracking (MPPT) for PV and Wind Turbine • Algorithms for MPPT 9. Integration and Grid Connection • Challenges and considerations for integrating renewable energy systems with the electrical grid • Power electronics for grid integration: converters, inverters, and control strategies • Grid synchronization and frequency regulation • Power quality issues and mitigation techniques • Grid codes, standards, and interconnection requirements 10. Energy Storage Technologies • Importance of energy storage in renewable energy systems • Battery technologies: lead-acid, lithium-ion, flow batteries • Thermal energy storage: sensible and latent heat storage • Pumped hydro storage and compressed air energy storage • Control and management of energy storage systems 11. Economic and Environmental Analysis • Economic feasibility assessment: cost analysis. • Environmental impact assessment: life cycle analysis, carbon footprint, emissions reduction • Policy and regulatory framework for renewable energy deployment • Incentives and subsidies for renewable energy projects • Case studies and real-world examples

	12. Sustainable Development and Future Trends • Role of renewable energy in achieving sustainable development goals • Energy transition and DE-carbonization strategies • Emerging trends in renewable energy research and technology • Innovation and advancements in renewable energy systems • Future prospects and challenges in the renewable energy sector

Learning and Teaching Strategies	
Strategies	Type something Like 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.

Student Workload (SWL)			
Structured SWL (h/sem)	63	**Structured SWL (h/w)**	4.2
Unstructured SWL (h/sem)	37	**Unstructured SWL (h/w)**	2.46
Total SWL (h/sem)	**100**		

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

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	Introduction to Renewable Energy Systems
Week 2	Solar Photovoltaic Systems
Week 3	Wind Energy Conversion Systems (WECS)
Week 4	Hydroelectric Power Systems
Week 5	Geothermal Energy Systems
Week 6	Biomass Energy Systems
Week 7	Power electronics for renewable energy systems
Week 8	Maximum power point (MPP)
Week 9	Maximum power point (MPP)
Week 10	Integration and Grid Connection
Week 11	Integration and Grid Connection
Week 12	Energy Storage Technologies
Week 13	Energy Storage Technologies
Week 14	Economic and Environmental Analysis
Week 15	Sustainable Development and Future Trends
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	• Energy harvesting by Alireza khaligh • Renewable Energy Systems Modelling, Optimization and Control • Power electronics for renewable energy systems, transportation and industrial applications by Haitham Abu-Rub	**yes**
Recommended Texts	Understanding Renewable Energy Systems by Volker Quaschning	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 FORM

Module Information				
Module Title	Engineering Project and Ethics		**Module Delivery**	
Module Type	Core		☒Theory ☒ Lecture ☐ Lab ☐ Tutorial ☒ Practical ☐ Seminar	
Module Code	EE426			
ECTS Credits	4			
SWL (hr/sem)	100			
Module Level	4		**Semester of Delivery**	Eight
Administering Department	Electrical Dep.		**College**	Engineering
Module Leader	Name		**e-mail**	E-mail
Module Leader's Acad. Title	Professor		**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	01/06/2023		**Version Number**	1.0

Relation with other Modules			
Prerequisite module	Engineering Project	**Semester**	7
Co-requisites module	None	**Semester**	

Module Aims, Learning Outcomes and Indicative Contents	
Module Objectives	The Engineering Project and Engineering Ethics module aims to equip students with the necessary knowledge and skills to successfully plan, execute, and manage engineering projects while adhering to ethical principles and professional standards. The module objectives are as follows: 1. Understand project management principles: Students will develop a solid understanding of the key principles and concepts of project management, including project planning, scheduling, budgeting, risk management, and resource allocation. They will learn how to apply these principles to engineering projects of varying scales and complexities. 2. Explore ethical theories and principles: Students will examine various ethical theories and principles that underpin decision-making in engineering. They will understand concepts such as utilitarianism, deontology, virtue ethics, and justice, and apply them to analyze ethical dilemmas encountered in engineering practice. 3. Analyze ethical issues in engineering: Students will critically analyze and evaluate ethical issues commonly faced by engineers, including conflicts of interest, environmental sustainability, safety considerations, intellectual property, and social implications of technological advancements. They will develop the ability to recognize and address ethical challenges within the engineering profession. 4. Promote ethical engineering practices: Students will explore strategies and techniques for promoting ethical practices in engineering.
Module Learning Outcomes	Upon completion of the Engineering Ethics module, students will be able to: 1. Possesses the theoretical and practical knowledge required in Electrical Engineering discipline. 2. Designs and performs an experiment, analyzes and interprets the results. 3. Identify and understand ethical theories and principles: Students will demonstrate knowledge and understanding of various ethical theories and principles and apply them to ethical decision-making in engineering contexts. 4. Evaluate ethical dilemmas in engineering: Students will be able to identify and analyze ethical dilemmas commonly encountered in engineering practice. 5. Communicate ethical considerations effectively: Students will effectively communicate ethical considerations in engineering contexts. 6. Propose ethical guidelines and practices: Students will be able to propose and develop ethical guidelines and best practices for engineering projects and organizations.
Indicative Contents	1. Introduction: Background Ideas, Why Study Engineering Ethics? Engineering Is Managing the Unknown , Personal vs. Professional Ethics , The Origins of Ethical Thought , Ethics and the Law , Ethics Problems Are Like Design Problems , Case Studies ,Summary. 2. Professionalism and Codes of Ethics: Introduction, Is Engineering a Profession? Codes of Ethics. 3. Understanding Ethical Problems: Introduction , A Brief History of Ethical Thought , Ethical Theories non-Western Ethical Thinking. 4. Ethical Problem-Solving Techniques: Introduction, Analysis of Issues in Ethical Problems , Line Drawing , Flow Charting , Conflict Problems, An Application of Problem-Solving Methods: Bribery/Acceptance of Gifts. 5. Risk, Safety, and Accidents: Introduction, Safety and Risk, Accidents.

	6. The Rights and Responsibilities of Engineers: Introduction, Professional Responsibilities, Professional Rights, Whistle-Blowing. 7. Ethical Issues in Engineering Practice: Introduction, Environmental Ethics, Computer Ethics, Ethics and Research. 8. Doing the Right Thing: See how ethical problems can be avoided; learn how engineers can cooperate with each other and with clients and government agencies to be sure that the ethically correct choice is made. Analysis current ethics problem like what happen in Volkswagen's company. 9. Selective Case Study

Learning and Teaching Strategies	
Strategies	Lecture, Discussion, Question and Answer, Observation, Field Trip, Team/Group Work, Preparing and/or Presenting Reports, Experiment, Drill and Practice, Case Study, Problem Solving, Brain Storming, Project Design/Management.

Student Workload (SWL)			
Structured SWL (h/sem)	48	**Structured SWL (h/w)**	3.2
Unstructured SWL (h/sem)	52	**Unstructured SWL (h/w)**	3.46
Total SWL (h/sem)	**100**		

Module Evaluation					
		Time/Number	**Weight (Marks)**	**Week Due**	**Relevant Learning Outcome**
Formative Assessment	**Projects**	1	35% (35)	Continuous	All
Summative assessment	**Exam**	1	15% (15)	16- Eighth semester	LO #1 - #7
	Final Exam	1	50% (50)	16- Eighth semester	All
Total assessment			100% (100 Marks)		

Delivery Plan (Weekly Syllabus)	
	Material Covered
Week 1	PROJECT WORK + 1 hr. engineering ethics
Week 2	PROJECT WORK + 1 hr. engineering ethics
Week 3	PROJECT WORK + 1 hr. engineering ethics
Week 4	PROJECT WORK + 1 hr. engineering ethics
Week 5	PROJECT WORK + 1 hr. engineering ethics
Week 6	PROJECT WORK + 1 hr. engineering ethics
Week 7	PROJECT WORK + 1 hr. engineering ethics
Week 8	PROJECT WORK + 1 hr. engineering ethics
Week 9	PROJECT WORK + 1 hr. engineering ethics
Week 10	PROJECT WORK + 1 hr. engineering ethics
Week 11	PROJECT WORK + 1 hr. engineering ethics
Week 12	PROJECT WORK + 1 hr. engineering ethics
Week 13	PROJECT WORK + 1 hr. engineering ethics
Week 14	PROJECT WORK + 1 hr. engineering ethics
Week 15	PROJECT WORK + 1 hr. engineering ethics
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		
Recommended Texts		
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.