



German Jordanian University

**School of Sustainable Systems
Engineering
Department of Electrical and Energy
Engineering
Bachelor of Science in Electrical
Engineering**

Study Plan 2023-2024

I. Program Objectives

The Electrical Engineering (EE) Department in the Faculty of Electrical Engineering and Information Technology at the German Jordanian University is obligated to graduate electrical engineers who will attain within a few years of graduation, the following assets:

- Provide basic knowledge of electrical engineering principles along with the required supporting knowledge of mathematics, science, computing, and engineering fundamentals.
- Graduate students that are capable to investigate emerging engineering problems and suggest suitable solutions.
- Develop the basic skills needed to perform and design experimental projects.
- Contribute and lead multi-disciplinary engineering teams with the gained skills and knowledge.
- Support the engineering and technological needs of local society.
- Succeed in the professional practice of engineering or related field.
- Pursue life-long learning through higher education and professional membership.

II. Learning Outcomes

Electrical Engineering department graduates bachelor's students with an understanding of fundamental Electrical engineering concepts, methodologies, and technologies as demonstrated by:

- An ability to apply knowledge of mathematics, science, and engineering
- An ability to design and conduct experiments, as well as to analyze and interpret data
- An ability to design a system, component, or process to meet desired needs
- An ability to function on multi-disciplinary teams
- An ability to identify, formulate, and solve engineering problems
- An understanding of professional and ethical responsibility
- An ability to communicate effectively
- The broad education necessary to understand the impact of engineering solutions in a global and societal context
- A recognition of the need for, and an ability to engage in, life-long learning
- A knowledge of contemporary issues
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
- Background for admission to engineering or other professional graduate programs

Course Delivery Methods

Courses are in one of the following three methods:

- **Face-to-Face (F2F) Method**

Courses that are taught through face-to-face learning are delivered at the university campus.

- **Blended (BLD) Method**

Courses in which teaching consists of face-to-face learning and asynchronous E-learning. The face-to-face learning takes place at the university campus. Asynchronous E-learning takes place through activities, tasks, educational duties, and assignments through the virtual E-learning platforms (Moodle and MyGJU) without direct meetings with course instructors.

- **Online (OL) Method**

Courses in which teaching consists of synchronous E-learning and asynchronous E-learning. Synchronous E-learning takes place through interactive virtual meetings between instructors and students directly through the virtual E-learning platform (MS Teams). Asynchronous E-learning takes place through activities, tasks, educational duties, and assignments through the virtual E-learning platforms (Moodle and MyGJU) without direct meetings with course instructors.

III. Admission Requirements

To apply for admission, the following minimum requirements must be met:

- a. A minimum grade of 80% in High School degree.

Placement Tests

Applicants must sit for placement tests in the Arabic Language, the English Language, and Mathematics to determine whether the applicant may be required to take remedial courses in the mentioned subjects. Depending on or the applicant scores in the placement tests, some of the following 3-credit-hour remedial courses are required:

Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
				Lect.	Prac.		
ARB0099	Elementary Arabic	3	3	3	-	OL	Placement test
ENGL0098	Elementary English	3	3	3	-	F2F	Placement test
ENGL0099	Intermediate English	3	3	3	-	F2F	ENGL0098
MATH0099	Pre-Math	3	3	3	-	OL	Placement test
Total		12	12	12	0		

- Remedial courses are to be completed and passed within the first year of enrollment.
- Passing grade of remedial courses is 60%.
- ECTS (B.Sc.): is the European Credit Transfer and Accumulation, One ECTS is equivalent to 30 actual workload hours.

IV. Degree Requirements

The requirements to obtain a B.Sc. degree in Electrical Engineering are the following:

- a. A minimum of 12 credit hours of elective courses are to be taken at a partner university in Germany.
- b. A minimum of 12 credit hours of International Training to be conducted at an industrial company in Germany.
- c. Passing all credit hours.

V. Framework for B.Sc. Degree (Credit Hours)

Classification	Credit Hours			ECTS		
	Compulsory	Elective	Total	Compulsory	Elective	Total
University Requirements	21	6	27			
School Requirements	27	0	27			
Program Requirements	108	12	120			
Total	156	18	174			

Course Delivery Method	Credit Hours	Percentage
Online Courses	18	10 %
Blended Courses	62	36 %
Face-to-Face Courses	94	54 %
Total	174	100%

1. University Requirements: (27 credit hours)

1.1. Compulsory: (21 credit hours)

Course ID	Course Name		Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
					Lect.	Prac.		
ARB100	Arabic		3	3	3	-	OL	ARB0099
ENGL1001	Upper-Intermediate English		3	3	3	-	F2F	ENGL0099
ENGL1002	Advanced English		3	3	3	-	F2F	ENGL1001
GERL101B1	German I B1-Track		3	6	9	-	F2F	-
GERL102B1	German II	B1-Track	3	6	9	-	F2F	GERL101B1
GERL102B2		B2-Track						
MILS100	Military Science		3	2	3	-	OL	-
NE101	National Education		3	2	3	-	OL	-
NEE101	National Education in English							
Total			21	25	33	0		

1.2. Elective: (6 Credit Hours) (two courses out of the following)

Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
				Lect.	Prac.		
DES101	Arts' Appreciation	3	3	3	-	OL	ENGL0099, ARB0099
EI101	Leadership and Emotional Intelligence	3	3	3	-	F2F	ENGL0099
IC101	Intercultural Communications	3	3	3	-	F2F	ENGL0099
PE101	Sports and Health	3	3	3	-	F2F	ARB0099
SE301	Social Entrepreneurship and Enterprises	3	3	3	-	F2F	ENGL0099
SFTS101	Soft Skills	3	3	3	-	OL	ENGL0099
BE302	Business Entrepreneurship	3	3	3	-	OL	ENGL0099
TW303	Technical and Workplace Writing	3	3	3	-	OL	ENGL0099
Minimum required		6	6	6	0		

2. School Requirements: (27 Credit Hours)

Course ID	Course Name		Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Co-requisites
					Lect.	Prac.		
GERL201B1	German III	B1-track	3		6	-	F2F	GERL102B1 or GERL102B2, ARB0099, ENGL0099, MATH0099
GERL201B2		B2-track						GERL102B2, ARB0099, ENGL0099, MATH0099
GERL202B1	German IV	B1-track	3		9	-	F2F	GERL201B1 or GERL201B2, ARB0099, ENGL0099, MATH0099
GERL202B2		B2-track						GERL201B2, ARB0099, ENGL0099, MATH0099
MATH101	Calculus I		3		3	-	BLD	MATH0099
MATH102	Calculus II		3		3	-	F2F	MATH101
EE317	Linear Algebra		3		3	-	BLD	MATH102
CS116	Computing Fundamentals		3		3	-	F2F	
CS1160	Computing Fundamentals Lab		1		3	-	BLD	CS116 ^{co}
CS117	Object Oriented Programming		3		3	-	F2F	CS116, CS1160, ARB0099, ENGL0099, MATH0099
CS1170	Object Oriented Programming Lab		1		-	3	BLD	CS117 ^{co} , CS116, CS1160, ARB099, ENGL099, MATH099
CE212	Digital Systems		3		3	-	F2F	CS116
CE2120	Digital Systems Lab		1		-	3	BLD	CE212 ^{co} , CS116
Total			27		36	6		

3. Program Requirements (120 credit hours)

3.1. Program Requirements (Compulsory): (108 credit hours)

Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Co-requisites
				Lect.	Prac.		
EE241	Electronics 1	3		3	-	F2F	ENE211, CS116, CS1160, ARB0099, ENGL0099, MATH0099
EE2410	Electronics 1 Lab	1		-	3	BLD	ENE211, EE241 ^{co} , ARB0099, ENGL0099, MATH0099
EE315	Probability, Statistics and Random Processes	3		3	-	BLD	MATH102 ^{co}
EE321	Communication Systems I	3		3	-	BLD	CE331
EE3210	Communication Systems I Lab	1		-	3	BLD	EE321 ^{co} , CE331
EE322	Communication Systems II	3		3	-	BLD	EE321, EE315 ^{co} , EE317 ^{co}
EE3220	Communication Systems II Lab	1		-	3	BLD	EE322 ^{co}
EE333	Electromagnetics	3		-	3	F2F	MATH203
EE343	Digital Electronics	3		3	-	F2F	EE241
EE3430	Digital Electronics Lab	1		-	3	BLD	EE343 ^{co} , EE241
EE361	Modeling and Simulation of Electrical Systems	1		-	3	BLD	CE331
EE393	Field Training*	0		160 hours		BLD	Dept. approval
EE492	Senior Project I **	1		-	-	BLD	Dept. approval
EE493	International Internship	12		20 weeks		BLD	Dept. approval
EE594	Senior Project II	3		-	-	OL	EE492
BM371	Numerical Methods for Engineers	3		2	3	BLD	MATH203, MATH205, CS116
CE201	Computer Architecture and Organization	3		3	-	F2F	CE212, CE2120
CE331	Signals and Systems	3		3	-	BLD	MATH203
CE352	Computer Networks	3		3	-	BLD	CE201
CE3561	Computer Networks Lab	1		-	3	BLD	CE201, CE352 ^{co}
CE441	Embedded System Design	3		3	-	F2F	CE201
CHEM103	General Chemistry	3		3	-	F2F	-
ENE211	Electrical Circuits I	3		3	-	F2F	PHYS104, ARB099, ENGL099, MATH099
ENE212	Electrical Circuits II	3		3	-	F2F	ENE211
ENE213	Electrical Circuits Lab	1		-	3	BLD	ENE211

ENE311	Electrical Machines		3		-	3	BLD	ENE212, EE333
ENE313	Electrical Machines Lab		1		-	3	BLD	ENE212, EE333, ENE311 ^{co}
ENE415	Power Systems		3		3	-	F2F	ENE311
GERL301B1	German V	B1-Track	3		9	-	F2F	GERL202B1 or GERL202B2
GERL301B2		B2-Track						GERL202B2
GERL302B1	German VI	B1-Track	3		6	-	F2F	GERL301B1 or GERL301B2
GERL302B2		B2-Track						GERL301B2
IE121	Engineering Workshop		1		-	3	F2F	
MATH203	Applied Mathematics for Engineers		3		3	-	F2F	MATH102, ARB099, ENGL099
MATH205	Differential Equations		3		3	-	F2F	MATH102, ARB099, ENGL099
ME0111	Computer Aided Engineering Drawing		2		-	3	BLD	CS116
ME0344	Control Systems I		3		3	-	F2F	CE331, EE361
ME0345	Control and Vibration Lab		1		-	3	BLD	CE331, EE361, ME0343 ^{co}
PHYS103	Physics I		3		3	-	BLD	
PHYS104	Physics II		3		3	-	F2F	PHYS103
PHYS106	Physics Lab		1		-	3	BLD	PHYS103, PHYS104 ^{co}
EE570	Cloud Computing and Big Data		3		3	-	F2F	CE352 ^{co}
EE521	5G and Beyond Wireless Technologies		3		3	-	F2F	EE321
EE5210	5G and Beyond Wireless Technologies Lab		1			3	BLF	EE321, EE521 ^{co}
	Total		108		77	81		

* The EE393 field training course should be registered after completing at least 115 credit hours of the study plan. The minimum number of training hours is 160 hours and should be performed in an organization that is highly related to the electrical engineering field. The training period should be connected without any gaps.

** The EE492 Senior project I course should be registered after completing the CE393 course

3.2. Program Requirements (Electives): (12 credit hours)

A minimum of 12 credit hours of engineering coursework are required. This list is open for modifications based on school council decisions.

Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Co-requisites
				Lect.	Prac.		
EE371	IoT Architecture and Protocols	3		3	-	BLD	BSC001
EE461	Digital Signal Processing	3		3	-	BLD	BSC001
EE510	Wireless and Mobile Communications	3		3	-	BLD	BSC001
EE511	Satellite Communication Systems	3		3	-	BLD	BSC001
EE514	Multimedia Communications	3		3	-	BLD	BSC001
EE531	Antennas	3		3	-	BLD	BSC001
EE532	RF and Microwave Engineering	3		3	-	BLD	BSC001
EE541	Electronic Communication Circuits	3		3	-	BLD	BSC001
EE551	Optical Fiber Communications	3		3	-	BLD	BSC001
EE560	Entrepreneurship in Electrical Engineering	3		3	-	BLD	BSC001
EE561	Areas of Future Research in Electrical Engineering	3		3	-	BLD	BSC001
EE562	Wireless Sensor Networks	3		3	-	BLD	BSC001
EE572	Special Topics in Artificial Intelligence of Things	3		3	-	BLD	BSC001
EE573	Special Topics in Smart Systems	3		3	-	BLD	BSC001
EE574	Special Topics of Emerging Communication Systems	3		3	-	BLD	BSC001
EE580	Special Topics in IoT Management and Automation	3		3	-	BLD	BSC001
EE582	Special Topics in IoT Devices	3		3	-	BLD	BSC001
EE583	Special Topics in IoT Electronics	3		3	-	BLD	BSC001
EE584	Special Topics in IoT Communications	3		3	-	BLD	BSC001
EE585	Special Topics in IoT System Design	3		3	-	BLD	BSC001
EE586	Special Topics in IoT Enabling Technologies	3		3	-	BLD	BSC001
EE587	Special Topics in IoT Applications	3		3	-	BLD	BSC001
EE588	Special Topics in IoT Energy Management	3		3	-	BLD	BSC001
EE595	Special Topics in Electrical Engineering	3		3	-	BLD	BSC001
EE596	Special Topics in Power Systems	3		3	-	BLD	BSC001
EE597	Special Topics in Communication Engineering	3		3	-	BLD	BSC001
EE598	Special Topics in Electronics	3		3	-	BLD	BSC001
EE599	Special Topics in Signal Processing	3		3	-	BLD	BSC001

CE342	Microprocessor and Microcomputer Systems	3		3	-	F2F	BSC001
CE354	Computer Security	3		3	-	BLD	BSC001
CE355	Data Communications	3		3	-	BLD	BSC001
CE444	Microcomputer Interface and Peripheral Devices	3		3	-	BLD	BSC001
CE452	Network Protocols	3		3	-	F2F	BSC001
CE461	Image Processing	3		3	-	BLD	BSC001
CE377	Machine learning	3		3	-	F2F	BSC001
CE521	Robotics	3		3	-	BLD	BSC001
CE552	Advanced Computer Networks	3		3	-	BLD	BSC001
CE561	Deep Learning	3		3	-	F2F	BSC001
CE563	Human Computer Interaction	3		3	-	F2F	BSC001
CE564	Pattern Recognition	3		3	-	F2F	BSC001
CE565	Computer Vision	3		3	-	F2F	BSC001
CS330	Image Understanding	3		2	2	F2F	BSC001
CS332	Computer Graphics	3		2	2	F2F	BSC001
CS263	Database Management Systems	3		2	2	BLD	BSC001
CS416	Systems Programming	3		2	2	F2F	BSC001
CS460	Data Mining	3		3	-	F2F	BSC001
CS4611	Big Data	3		3	-	F2F	BSC001
CS357	Cybersecurity	3		3	-	BLD	BSC001
CS4731	Ethical Hacking	3		3	-	BLD	BSC001
ENE433	Solar Energy I	3		3	-	BLD	BSC001
ENE516	Smart-Grids	3		3	-	BLD	BSC001
ENE517	Power Systems Protection	3		3	-	BLD	BSC001
ENE518	High Voltage Engineering	3		3	-	BLD	BSC001
ENE530	Advanced Renewable Energy Systems	3		3	-	BLD	BSC001
EE576	Special Topics in Wireless Energy Management	3		3	-	BLD	BSC001
EE577	Special Topics in Software Defined Networks	3		3	-	BLD	BSC001
EE578	Special Topics in Device-to-Device Communications	3		3	-	BLD	BSC001
ENE537	Energy Efficiency, Management and Laws	3		3	-	BLD	BSC001
ENE547	Power System Stability	3		3	-	BLD	BSC001
Minimum required		12		12	0		

^b All elective courses to be taken at a partner university in Germany.

Study Plan ^c Guide for B.Sc. Degree in Electrical Engineering (General Track)

First Year							
First Semester							
Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
				Lect.	Prac.		
ARB100	Arabic	3		3	-	OL	ARB0099
CS116	Computing Fundamentals	3		3	-	F2F	
CS1160	Computing Fundamentals Lab	1		-	3	BLD	CS116 ^{co}
GERL101B1	German I B1-Track	3		9	-	F2F	
MATH101	Calculus I	3		3	-	BLD	MATH0099
PHYS103	Physics I	3		3	-	BLD	
ENGL1001	Upper-Intermediate English	3		3	-	F2F	ENGL0099
Total		19		24	3		

First Year								
Second Semester								
Course ID	Course Name		Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
					Lect.	Prac.		
CHEM103	General Chemistry		3		3	-	F2F	
CS117	Object Oriented Programming		3		3	-	F2F	CS116, CS1160
CS1170	Object Oriented Programming lab		1		-	3	BLD	CS116, CS1160 ^{co} , CS117 ^{co}
GERL102B1	German II	B1-track	3		9	-	F2F	GERL101B1
GERL102B2		B2-track						
ENGL1002	Advanced English		3		3	-	F2F	ENGL1001
MATH102	Calculus II		3		3	-	F2F	MATH101
PHYS104	Physics II		3		3	-	F2F	PHYS103
PHYS106	Physics Lab		1		-	3	BLD	PHYS103, PHYS104 ^{co}
Total			20		24	6		

^c The following study plan guide does not take into account possible remedial courses.

Second Year								
First Semester								
Course ID	Course Name		Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
					Lect.	Prac.		
GERL201B1	German III	B1-track	3		9	-	F2F	GERL102B1 or GERL102B2, ARB0099, ENGL0099, MATH0099
GERL201B2		B2-track						GERL102B2, ARB0099, ENGL0099, MATH0099
CE212	Digital Systems		3		3	-	F2F	CS116, ARB0099, ENGL0099, MATH0099
CE2120	Digital Systems Lab		1		-	3	BLD	CE212 ^{co} , ARB0099, ENGL0099, MATH0099
MATH203	Applied Mathematics for Engineers		3		3	-	F2F	MATH102, ARB0099, ENGL0099, MATH0099
ENE211	Fundamentals of Electrical Circuits		3		3	-	F2F	PHYS104, MATH203 ^{co} , ARB099, ENGL099, MATH099
ENE213	Electrical Circuits Lab		1		-	3	BLD	ENE211, ARB099, ENGL099, MATH099
IE121	Workshop		1		-	3	F2F	
	University Elective Course		3		3	-		
Total			18		20	11		

Second Year								
Second Semester								
Course ID	Course Name		Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
					Lect.	Prac.		
CE201	Computer Architecture and Organization		3		3	-	F2F	CE212, ARB0099, ENGL0099, MATH0099
CE331	Signals and Systems		3		3	-	BLD	MATH203
ENE212	Electrical Circuits and Systems Analysis		3		3	-	F2F	ENE211, ARB0099, ENGL0099, MATH0099
MATH205	Differential Equations		3		3	-	F2F	MATH102, ARB0099, ENGL0099, MATH0099
ME0111	Computer Aided Engineering Drawing		2		-	3	BLD	CS116
GERL202	German IV	B1-track	3		9	-	F2F	GERL202B1 or GERL202B2,

F2F: Face-to-face

BLD: Blended

OL: Online

co: Corequisite

								ARB0099, ENGL0099, MATH0099
		B2-track						GERL202B2, ARB0099, ENGL0099, MATH0099
EE315	Probability, Statistics and Random Processes		3		3	-	BLD	MATH102 ^{co}
Total			20		24	3		

Third Year								
First Semester								
Course ID	Course Name		Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
					Lect.	Prac.		
CE352	Computer Networks		3		3	-	BLD	CS116, CE201
EE241	Electronics 1		3		3	-	F2F	ENE211, CS116, CS1160, ARB0099, ENGL0099, MATH0099
EE2410	Electronics 1 Lab		1		-	3	BLD	ENE211, EE241 ^{co} , ARB0099, ENGL0099, MATH0099
EE317	Linear Algebra		3		3	-	BLD	MATH102
EE321	Communication Systems I		3		3	-	BLD	CE331
EE3210	Communication Systems I Lab		1		3	3	BLD	EE321
EE333	Electromagnetics		3		3	-		MATH203
GERL301B1	German V	B1-Track	3		9	-	F2F	GERL202B1 or GERL202B2
GERL301B2		B2-Track						GERL202B2
Total			20		27	6		

Third Year								
Second Semester								
Course ID	Course Name		Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
					Lect.	Prac.		
BM371	Numerical Methods for Engineers		3		3	-	BLD	MATH203, MATH205, CS116
CE3561	Computer Networks Lab		1		-	3	BLD	CE352 ^{co}
EE361	Modeling and Simulation of Electrical Systems		1		-	3	BLD	CE331
EE393	Field Training		0		-	-	F2F	Dept. approval
EE322	Communication Systems II		3		3	-	BLD	EE321, EE315 ^{co} , EE317 ^{co}
EE3220	Communication Systems II Lab		1		-	3	BLD	EE322 ^{co}
EE342	Electronics II		3		3	-	F2F	EE241
ENE311	Electrical Machines		3				BLD	ENE212, EE333
ENE313	Electrical Machines Lab		1		-	3	BLD	ENE311 ^{co}
GERL302B1	German VI	B1-Track	3		6	-	F2F	GERL301B1 or GERL301B2
GERL302B2		B2-Track						GERL301B2
Total			19		15	12		

Fourth Year							
First Semester							
Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
				Lect.	Prac.		
	Program Elective Course	3		3	-	F2F	
	Program Elective Course	3		3	-	F2F	
	Program Elective Course	3		3	-	F2F	
	Program Elective Course	3		3	-	F2F	
Total		12		12	0		

Fourth Year							
Second Semester							
Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
				Lect.	Prac.		
EE493	International Internship	12		-	36	BLD	
Total		12		0	36		

German year prerequisites:

Passing two out of the following three courses:

- EE321 Communication Systems I
- CE352 Computer Networks
- ENE311 Electrical Machines

^d Courses attended and/or passed during International Internship are not transferable

Fifth Year							
First Semester							
Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
				Lect.	Prac.		
CE441	Embedded System Design	3		3	-	F2F	CE201
EE343	Digital Electronics	3		3	-	F2F	EE241
EE3430	Digital Electronics Lab	1		-	3	BLD	EE343 ^{co}
EE492	Senior Project I	1		-	-	BLD	Dept. approval
EE570	Cloud Computing and Big Data	3		3	-	F2F	CE352
EE521	5G and Beyond Wireless Technologies	3		3	-	F2F	EE321
EE5210	5G and Beyond Wireless Technologies Lab	1		-	3	BLD	EE521 ^{co}
	University Elective Course	3		3	-		
Total		18		15	6		

Fifth Year							
Second Semester							
Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
				Lect.	Prac.		
EE594	Senior Project II	3		-	-	OL	EE492
ENE415	Power systems	3		3	-	F2F	ENE311
MILS100	Military Science	3		3	-	OL	
ME0344	Control Systems I	3		3	-	F2F	CE331, EE361
ME0345	Control and Vibration Lab	1		-	3	BLD	ME0344 ^{co}
NE101	National Education	3		3	-	OL	
Total		16		15	3		

VI. Compulsory Courses Offered by EE Department

EE241 Electronics I	3 Cr Hr (3,0)	ECTS
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Introduction to semiconductor electronic devices. Semiconductor diodes circuits and applications. Clipper, clamper, and rectifier circuits. npn and pnp BJT and JFET transistor. BJT and JFET DC analysis. BJT AC analysis. Introduction to MOSFET and MESFET transistors. Introduction to OP-amps circuits and applications.

Prerequisites: ENE211, CS116, CS1160, ARB0099, ENGL0099, MATH0099

EE2410 Electronics I Lab	1 Cr Hr (0,3)	ECTS
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Diode and diode applications including clipper, full-wave and half-wave rectifier, clamper, and voltage Doubler and Tripler. BJT transistor DC analysis for different configurations: Common base, common emitter, and common collector. BJT AC analysis. JFET DC analysis. Introduction to Op-amp.

Prerequisites: ENE211, EE241^{co}, ARB0099, ENGL0099, MATH0099

EE315 Probability, Statistics and Random Processes	3 Cr Hr (3,0)	ECTS
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Fundamentals of probability, sample space, random variables expectations, Bernoulli and Poisson processes, continuous single random variable, PDF, CDF and conditional distributions, famous distributions (Gaussian, uniform, exponential, etc), transformation of random variables, joint random variables operations, joint PDF and joint CDF, random processes temporal characteristics and concepts of stationarity, ergodicity and correlation. Introduction to the basics of statistics, descriptive statistics, and hypothesis testing.

Prerequisites: MATH102^{co}

EE317 Linear Algebra	3 Cr Hr (3,0)	ECTS
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Introduction to Vectors and Matrices. Vector and matrix derivatives. Systems of linear equations. Vector spaces and subspaces. Independence, bases and dimensions. The fundamental four spaces. Orthogonality and Gram-Schmidt process. Projection and projection matrices. Linear models and least squares problems. Determinants and their properties. Eigenvalues and eigenvectors. Matrix decompositions such as LU decomposition, Eigen-decomposition, Singular Value Decomposition. Applying these tools in a wide range of engineering applications.

Prerequisites: MATH102

EE321 Communication Systems I	3 Cr Hr (3,0)	ECTS
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Introduction to communication system. Revision of basic signal and systems. Amplitude modulations, Angle Modulation, Signal spectrum. Signal-to-noise ratio. Introduction to digital systems. Analog to digital conversion. Sampling. Quantization. Line Coding. Delta and sigma-delta modulation.

Prerequisites: CE331

EE3210 Communication Systems I Lab	1 Cr Hr (0,3)	ECTS
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AM modulation. Envelope detector. Coherent receiver. FM modulation transmission and reception, single sideband communication (SSB) communication technique. Noise Sources. Signal to noise ratio (SNR). Pulse modulation. Pulse code Modulation (PCM). Delta modulation, DPCM.

Prerequisites: EE321^{co}, CE331

EE322 Communication Systems II	1 Cr Hr (3,0)	ECTS
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A/D and D/A conversion. Sampling. Quantization. Line coding. Digital modulation. PSK, QAM, and PAM. SNR measurement. BER calculation. Eye diagram. Channel coding. Optimum receiver.

Prerequisites: EE321, EE315^{co}, EE317^{co}

EE3220 Communication Systems II Lab	1 Cr Hr (0,3)	ECTS
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A/D and D/A conversion. Sampling. Quantization. Line coding. Digital modulation. PSK, QAM, and PAM. SNR measurement. BER calculation. Eye diagram. Channel coding. Optimum receiver.

Prerequisites: EE322^{co}

EE333 Electromagnetics	1 Cr Hr (3,0)	ECTS
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Electrostatic fields, magneto-static fields, solution of Laplace's and Poisson's equations, Faraday's law and applications, Maxwell's equations, plane waves: propagation, reflection and refraction, transmission lines.

Prerequisites: MATH203

EE342 Electronics II	3 Cr Hr (3,0)	ECTS
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BJT and FET frequency response. Power amplifiers (Class A, Class B and Class C). Operational amplifiers analysis and applications. Introduction to power electronics devices, steady-state operations of choppers, rectifiers, and inverters.

Prerequisites: EE241

EE343 Digital Electronics	3 Cr Hr (3,0)	ECTS
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General properties and definitions of digital circuits. Review of BJT and its modes of operation. Resistor Transistor Logic (RTL). Diode Transistor Logic (DTL). Transistor – Transistor Logic (TTL). Emitter – coupled Logic (ECL). Review of Field Effect Transistors (FET). Metal Oxide Semiconductor FETs (MOSFETs). MOS digital Circuits: NMOS, N-channel MOSFET, PMOS, and CMOS families. Regenerative Logic Circuits: bistable, monostable and astable multivibrators. D/A and A/D converters.

Prerequisites: EE241

EE3430 Digital Electronics Lab	3 Cr Hr (0,3)	ECTS
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Electric Characteristics of the TTL logic gates; Multiplexer and De-multiplexer; R-S & J-K Flip-Flops; TTL Logic Family; CMOS Logic Family; Interfacing TTL and CMOS logic Gates; Comparator & Schmitt trigger; 555 Timer as Monostable and astable multivibrators; Square Wave & Ramp Generators.

Prerequisites: EE343^{co}, EE241

EE361 Modeling and Simulation of Electrical Systems	1Cr Hr (0,3)	ECTS
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The course will cover the usage of simulation tools required to simulate electrical systems. In particular, Matlab/Simulink based simulation and Labview simulation platforms will be targeted. The course entails description of the simulation platform with particular focus in related application and Monte Carlo simulations. Different example and models will be built and simulated.

Prerequisites: CE331

EE393 Field Training	0 Cr Hr (160 hours)	ECTS
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Students must complete 160 hours of field training in approved industries in Jordan by the end of their third academic year.

Prerequisites: Dept. approval

EE492 Senior Project I	3 Cr Hr (3,0)	ECTS
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Theoretical investigation and practical implementation of a special project under the supervision of an academic faculty member, detailed report as well as an oral examination are required.

Prerequisites: Dept. approval

EE594 Senior Project II	3 Cr Hr (3,0)	ECTS
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F2F: Face-to-face

BLD: Blended

OL: Online

co: Corequisite

Theoretical investigation and practical implementation of a special project under the supervision of an academic faculty member. Detailed report as well as an oral examination are required.

Prerequisites: EE492

EE49 International Internship	12 Cr Hr (20 Weeks)	ECTS
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A training period of six months to be spent in the industry in Germany, under a follow up of academic faculty in Jordan and in Germany. Periodic reports and a final report need to be submitted for evaluation and an oral examination is required.

Prerequisites: Dept. approval

EE521: 5G and Beyond Wireless Technologies	3 Cr Hr (3,0)	ECTS
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Comprehensive exploration of wireless communication technologies, tracing their evolution from 2G to 5G and examining the future of Beyond 5G (B5G) and 6G. Students will gain in-depth knowledge of key wireless architectures, core technologies, and emerging innovations shaping next-generation networks.

Prerequisites: EE321

EE5210 5G and Beyond Wireless Technologies Lab	1 Cr Hr (3,0)	ECTS
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The lab will focus on simulating, analyzing, and testing 5G communications systems. The lab will be based on MATLAB simulation while using SDR for hardware implementation and testing. The lab will address 5G channel modeling, physical layer components, signal reception, and will aim to build an end-to-end 5G communication system.

Prerequisites: EE321, EE521^{co}

EE570 Cloud Computing and Big Data	3Cr Hr (3,0)	ECTS
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Cloud computing: Journey to the Cloud, Classic Data Center (CDC), Application, DBMS, Compute and Storage, Networking, Object based and Unified storage technologies Business continuity overview and backup, Replication technologies. Virtualized Data Center (VDC) – Compute virtualization overview, Compute virtualization techniques, Virtual Machines, Resource management techniques, Physical to virtual conversion, Storage virtualization overview, Virtual Machine Storage. Virtualized Data Center – Networking, VDC networking overview, VDC networking components VLAN and VSAN technologies, Network traffic management. Virtualized Data Center – Desktop and Application, Desktop virtualization, Application virtualization. Big Data: Introduction and Motivation, Big Data infrastructure, Data Analytics Lifecycle, Basic Data Analytic Methods, Distributed file system such as HDFS, Distributed processing engines such as Map Reduce.

Prerequisites: CE352^{co}

VII. Elective Courses Offered by EE Department

EE371 IoT Architecture and Protocols	3Cr Hr (3,0)	ECTS
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IoT architecture, IoT solutions and applications, IoT architecture, sensors and actuators, common IoT communication technologies and solutions, NB-IoT communication technologies and solutions, 5G communication technologies and solutions, industrial IoT gateways, home IoT gateways, and IoT industry applications and solutions. IoT cloud and edge-computing platforms.

Prerequisites: BSC001

EE461 Digital Signal Processing	3 Cr Hr (3,0)	ECTS
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Digital Signal Processing begins with a discussion of the analysis and representation of discrete-time signal systems, including discrete-time convolution, difference equations, the z-transform, and the discrete-time Fourier transform. The course proceeds to cover digital network. FIR and IIR digital filters design. The fast Fourier transform algorithm for computation of the discrete Fourier transform.

Prerequisites: BSC001

EE510 Wireless and Mobile Communications	3 Cr Hr (3,0)	ECTS
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Overview of current and future wireless systems and standards. Cellular concept and structure. Cellular queuing theory. Large-scale fading including Ferris model, two-ray model, random log-normal shadowing, diffraction losses and Fresnel-zone concept. Small-scale fading and channel specification. Coherence bandwidth and coherence time. Rayleigh fading and analysis. Characterization of the wireless channel. Introduction to advanced wireless techniques including: OFDM, MIMO, 3G, multiple access, etc.

Prerequisites: BSC001

EE541 Electronic Communication Circuits	3 Cr Hr	ECTS
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Introduction to noise, amplitude modulators and demodulators (mixers, conversion loss and intermodulation distortion in mixers) AM transmitters, super heterodyne receiver, angle modulators and discriminators, limiters, gain controlled amplifiers, phase detectors, voltage-controlled oscillators (VCO), phase-locked loops (PLL), high-frequency amplifiers, FM receivers, digital modulation circuits and systems, time and frequency division multiplexing.

Prerequisites: BSC001

EE544 Sensors and Actuators	3 Cr Hr (3,0)	ECTS
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Sensing and actuation in system instrumentation, Interfacing circuits, Application scenarios of sensors and actuators, Instrumentation process and steps, Application examples, Data acquisition and processing, Digital transducers, Sensor technologies.

Prerequisites: BSC001

EE511 Satellite Communication Systems	3 Cr Hr (3,0)	ECTS
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History of satellites. Orbital and geostationary satellites. Mechanical fundamentals for satellites. Orbital patterns. Look angles. Orbital spacing. Radiation pattern. Satellite system. Link models. Uplink model. Down link model. Transponder. Link budget equations and calculations. Digital modulation and channel coding techniques used in satellites. Losses and attenuation of waves between satellites and earth. Impact of weather conditions.

Prerequisites: BSC001

EE514: Multimedia Communications	3 Cr Hr (3,0)	ECTS
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Introduction to audio and video signals, audio and video Signal Compression, audio/video processing tools, computer graphic tools and Video Production tools, Design fundamentals: Points, lines, design and creativity, Multimedia Processors, Multimedia Networks and Applications: Audio and Video Conferencing. Multimedia application over the Intranet and the Internet. In the aspect of multimedia networking, special considerations for sending multimedia over the Internet and wireless networks, such as video adaptation, error resilience, error concealment, and quality of service will be discussed. Note: the course will encourage the usage of open access software such as Audacity, Speex, and FFMPEG.

Prerequisites: BSC001

EE531 Antennas	3 Cr Hr (3,0)	ECTS
Antenna parameters: gain, directivity, efficiency, input impedance, radiation pattern. Theory of transmitting and receiving antennas: reciprocity, equivalence, and induction theorems. Linear wire antennas: dipoles and monopoles. Loop and traveling-wave antennas. Antenna arrays: linear and phased arrays. Aperture antennas, reflector antennas, and microstrip antennas. Computer aided design: student projects using antenna simulation tools.		
<i>Prerequisites: BSC001</i>		
EE532 RF and Microwave Engineering	3 Cr Hr (3,0)	ECTS
Microwave applications (terrestrial and satellite communications, radar, remote sensing, wireless communications) and their system and component requirements. Review of Maxwell's equations. Propagation modes of transmission lines (TEM, waveguide, micro strip), S-parameter matrix modeling of discontinuities, junctions and circuits (impedance transformers, directional couplers, hybrids, filters, circulators, solid-state amplifiers and oscillators). Microwave computer aided design examples.		
<i>Prerequisites: BSC001</i>		
EE551 Optical Fiber Communications	3 Cr Hr (3,0)	ECTS
Components and system design of optical fiber communication. Types of fibers (single- and multi-mode and step-index and graded-index fibers), how they work, phenomena that degrade signals and how to mitigate them (attenuation, modal dispersion, group-velocity dispersion), light sources, detectors, amplifiers, networks, and systems. Wavelength-Division Multiplexing. Introduction to optical wireless communication.		
<i>Prerequisites: BSC001</i>		
EE560 Entrepreneurship in Electrical Engineering	3 Cr Hr (3,0)	ECTS
The course will discuss the emergence of new technologies in electrical engineering focusing particularly on technology entrepreneurial opportunities and its process in electrical engineering industries. In addition, the course will identify high-potential, technology-intensive commercial opportunities and reviewing what is relevant and currently discussed in industry.		
<i>Prerequisites: BSC001</i>		
EE561 Areas of Future Research in Electrical Engineering	3 Cr Hr (3,0)	ECTS
The course will discuss future research directions in various electrical engineering fields, which may include but not limited to, antennas, microwave, optics, communication and information systems, quantum information, pattern analysis and machine intelligence.		
<i>Prerequisites: BSC001</i>		
EE562 Wireless Sensor Networks	3 Cr Hr (3,0)	ECTS
Wireless Sensor Networks definition, applications, major components and architecture, clustering protocols, routing protocols, wireless communication protocols, implementation platforms, power saving modes. Interrupts, Security.		
<i>Prerequisites: BSC001</i>		
EE571 Industrial IoT	3 Cr Hr (3,0)	ECTS
IIoT definition, requirements, communication protocol specifications. IIoT wired and wireless communication protocols such as: EIA-232 Interface Standard, EIA-485 Interface Standard, Current loop and EIA-485 converters, Modbus, ProfiBus, WirelessHART, ISA100.11a, WIA-PA and OPC, Scada systems. IIoT applications such as: preventive maintenance, objects training and monitoring, IIoT role in Industry 4.0 and next generation networks.		
<i>Prerequisites: BSC001</i>		
EE572 Special Topics in Artificial Intelligence of Things	3 Cr Hr (3,0)	ECTS
This course introduces the students to the fundamentals of artificial intelligence algorithms along with their implementation. Then, apply these algorithms in various applications in IoT. Topics may vary each time the course		

is offered. Details of the course will be advertised by the department at the time of offering.

Prerequisites: BSC001

EE573 Special Topics in Smart Systems	3 Cr Hr (3,0)	ECTS
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This course is offered to senior level students in electrical\5G engineering. It gives them exposure to special topics related to smart systems. Topics may vary each time the course is offered. Details of the course will be advertised by the department at the time of offering.

Prerequisites: BSC001

EE574 Special Topics of Emerging Communication Systems	3 Cr Hr (3,0)	ECTS
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This course is offered to senior level students in electrical\5G engineering. It gives them exposure to special topics related to the applications of emerging communication systems. Topics may vary each time the course is offered. Details of the course will be advertised by the department at the time of offering.

Prerequisites: BSC001

EE575 Special Topics in Radio Access Technologies	3 Cr Hr (3,0)	ECTS
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This course is offered to senior level students in electrical\IoT and 5G engineering. It gives them exposure to special topics related to radio access technologies. Topics may vary each time the course is offered. Details of the course will be advertised by the department at the time of offering.

Prerequisites: BSC001

EE576 Special Topics in Wireless Systems Energy Management	3 Cr Hr (3,0)	ECTS
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This course is offered to senior level students in electrical\5G engineering. It gives them exposure to special topics related to wireless systems energy management. Topics may vary each time the course is offered. Details of the course will be advertised by the department at the time of offering.

Prerequisites: BSC001

EE577 Special Topics in Software Defined Networks	3 Cr Hr (3,0)	ECTS
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This course is offered to senior level students in electrical\5G engineering. It gives them exposure to special topics related to software defined networks. Topics may vary each time the course is offered. Details of the course will be advertised by the department at the time of offering.

Prerequisites: BSC001

EE578 Special Topics in Device-to-Device Communications	3 Cr Hr (3,0)	ECTS
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This course is offered to senior level students in electrical\5G engineering. It gives them exposure to special topics related to Device-to-Device communications. Topics may vary each time the course is offered. Details of the course will be advertised by the department at the time of offering.

Prerequisites: BSC001

EE580 Special Topics in IoT Management and Automation	3 Cr Hr (3,0)	ECTS
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This course is offered to senior level students in electrical\IoT engineering. It gives them exposure to special topics related to IoT management and automation. Topics may vary each time the course is offered. Details of the course will be advertised by the department at the time of offering.

Prerequisites: BSC001

EE582 Special Topics in IoT Devices	3 Cr Hr (3,0)	ECTS
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This course is offered to senior level students in electrical\IoT engineering. It gives them exposure to special topics related to IoT devices. Topics may vary each time the course is offered. Details of the course will be advertised by the department at the time of offering.

Prerequisites: BSC001

EE583 Special Topics in IoT Software Application Development	3 Cr Hr (3,0)	ECTS
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F2F: Face-to-face

BLD: Blended

OL: Online

co: Corequisite

This course is offered to senior level students in electrical\IoT engineering. It gives them exposure to special topics related to IoT software application development. Topics may vary each time the course is offered. Details of the course will be advertised by the department at the time of offering.

Prerequisites: BSC001

EE584 Special Topics in IoT Electronics	3 Cr Hr (3,0)	ECTS
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This course is offered to senior level students in electrical\IoT engineering. It gives them exposure to special topics related to IoT electronics. Topics may vary each time the course is offered. Details of the course will be advertised by the department at the time of offering.

Prerequisites: BSC001

EE585 Special Topics in IoT Communications	3 Cr Hr (3,0)	ECTS
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This course is offered to senior level students in electrical\IoT engineering. It gives them exposure to special topics related to IoT communications. Topics may vary each time the course is offered. Details of the course will be advertised by the department at the time of offering.

Prerequisites: BSC001

EE586 Special Topics in IoT System Design	3 Cr Hr (3,0)	ECTS
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This course is offered to senior level students in electrical\IoT engineering. It gives them exposure to special topics related to IoT system design. Topics may vary each time the course is offered. Details of the course will be advertised by the department at the time of offering.

Prerequisites: BSC001

EE587 Special Topics in IoT Enabling Technologies	3 Cr Hr (3,0)	ECTS
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This course is offered to senior level students in electrical\IoT engineering. It gives them exposure to special topics related to IoT enabling technologies. Topics may vary each time the course is offered. Details of the course will be advertised by the department at the time of offering.

Prerequisites: BSC001

EE588 Special Topics in IoT Enabling Applications	3 Cr Hr (3,0)	ECTS
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This course is offered to senior level students in electrical\IoT engineering. It gives them exposure to special topics related to IoT enabling applications. Topics may vary each time the course is offered. Details of the course will be advertised by the department at the time of offering.

Prerequisites: BSC001

EE589 Special Topics in IoT Enabling Energy Management	3 Cr Hr (3,0)	ECTS
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This course is offered to senior level students in electrical\IoT engineering. It gives them exposure to special topics related to IoT enabling energy management. Topics may vary each time the course is offered. Details of the course will be advertised by the department at the time of offering.

Prerequisites: BSC001

EE595 Special Topics in Electrical Engineering	3 Cr Hr (3,0)	ECTS
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Selected topics in contemporary electrical engineering technologies, which may include but not limited to, circuit design and analysis, control systems, electromagnetic, antennas, RF and microwave, signal processing, image processing, compressive sensing and sparse recovery, nanotechnology, very large-scale integrated circuits (VLSI), micro-electro-mechanical systems (MEMS), optical engineering.

Prerequisites: BSC001

EE596 Special Topics in Power Systems	3 Cr Hr (3,0)	ECTS
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Selected topics in contemporary power engineering technologies, which may include but not limited to power generation, transmission and storage, power economics, power system operation and planning, power quality control and monitoring, power system reliability and protection, renewable energy, smart grids.

Prerequisites: BSC001

EE597 Special Topics in Communication Engineering	3 Cr Hr (3,0)	ECTS
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The course will cover recent advances in communication engineering technologies, which may include but not limited to, IoT and applications, smart grids communication systems, wireless sensor networks, low range—low power wireless communication, MIMO system, multiple access techniques (TDMA, CDMA, OFDMA, NOMA), multi—carrier communication, free—space optics and visible light communication.

Prerequisites: BSC001

EE598 Special Topics in Electronic Engineering	3 Cr Hr (3,0)	ECTS
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The course will cover recent advances in electronic engineering technologies, which may include but not limited to, microelectronics, active filters, oscillators, data converters, signal generators, digital electronics, lasers and optoelectronics, high speed circuits, advanced semiconductor devices, RF/Gigahertz/Terahertz circuits, integrated circuits, VLSI circuits.

Prerequisites: BSC001

EE599 Special Topics in Signal Processing	3 Cr Hr	ECTS
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The course will cover recent advances in signal processing, which may include but not limited to, transforms, digital filters (structures, design, and implementation), numerical roundoff errors, quantization effects, introduction to multi-rate signal processing, power spectrum estimation, linear prediction, Weiner filtering, parameter estimation, signal detection, hypothesis tests, likelihood ratio tests, time-frequency analysis, space-time processing, the Short-time Fourier Transform, compressive sensing and sparse recovery.

Prerequisites: BSC001

EE541 Electronic Communication Circuits	3 Cr Hr (3,0)	ECTS
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Introduction to noise, amplitude modulators and demodulators (mixers, conversion loss and intermodulation distortion in mixers) AM transmitters, super heterodyne receiver, angle modulators and discriminators, limiters, gain controlled amplifiers, phase detectors, voltage-controlled oscillators (VCO), phase-locked loops (PLL), high-frequency amplifiers, FM receivers, digital modulation circuits and systems, time and frequency division multiplexing.

Prerequisites: EE241, EE321

EE5410 Electronic Communication Circuits Lab	1 Cr Hr (0,3)	ECTS
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Noise and noise sources. AM modulation and demodulation circuits including mixers, super heterodyne receiver. Phase modulators and discriminators, limiters, gain controlled amplifiers, phase detectors, voltage-controlled oscillators (VCO), phase-locked loops (PLL), high-frequency amplifiers, FM receiver.

Prerequisites: EE241, EE321, EE541^{co}

EE510 Wireless and Mobile Communications	3 Cr Hr (3,0)	ECTS
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Overview of current and future wireless systems and standards. Cellular concept and structure. Cellular queuing theory. Large-scale fading including Ferris model, two-ray model, random log-normal shadowing, diffraction losses and Fresnel-zone concept. Small-scale fading and channel specification. Coherence bandwidth and coherence time. Rayleigh fading and analysis. Characterization of the wireless channel. Introduction to advanced wireless techniques including: OFDM, MIMO, multiple access, etc.

Prerequisites: EE315

VIII. Course Offered by Other Departments

CE201 Computer Architecture and Organization	3 Cr Hr (3,0)	ECTS
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Basic computer organization, central processing unit, micro-program control and control unit, arithmetic processor, memory units, bus structures, interrupt structures. Taxonomies of computer architectures; addressing methods, programs control, processing units, I-O organization, arithmetic, main-memory organization, peripherals, microprocessor families, RISC architectures and multiprocessors. Von Neumann; Baseline of processor architecture; Memory organization; Parallel computing.

Prerequisites: CE212, CE2120

CE212 Digital Systems	3 Cr Hr (3,0)	ECTS
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Fundamentals of digital electronics, Binary number system; Boolean algebra, logic operations, algebra and gates, digital circuits analysis, gate-level and block level design of digital circuits, adders, subtractors, comparators, multiplexers, decoders, analysis, design and applications of sequential circuits: flip-flops, registers, counter, and their design procedures, RAM and ROM memory elements.

Prerequisites: CS116

CE2120 Digital Systems Lab	1 Cr Hr (0,3)	ECTS
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The course also includes 3-hours lab session every week to enhance hands-on experience on topics that are theoretically covered in the CE212 course, including basic logic gate experiments, combinational logic circuits experiments, and sequential logic circuits experiments. The experiments on all topics vary from functional troubleshooting to gate and block level design implementation.

Prerequisites: CE212^{co}, CS116

CE331 Signals and Systems	3 Cr Hr (3,0)	ECTS
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Concepts and mathematical tools in continuous and discrete-time signal processing and linear systems analysis with examples from digital signal processing, communications, and control. Discrete-time signal models. Continuous-discrete-continuous signal conversion. Discrete-time impulse and step response. Frequency domain representations: Fourier series and transforms. Connection between continuous and discrete time frequency representations. Discrete Fourier transform (DFT) and fast Fourier transform (FFT). Digital filter and signal processing examples. Discrete-time and hybrid linear systems. Stability and causality. Z transforms and their connection to Laplace transforms. Frequency response of discrete-time systems.

Prerequisites: MATH203

CE352 Computer Networks	3 Cr Hr (3,0)	ECTS
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Study of computer network architectures, protocols, and interfaces. The OSI reference model and Internet architecture. Network models: LAN and WAN; Networking techniques such as multiple access, packet/cell switching, inter-networking, end-to-end protocols, and congestion control; IP, UDP and TCP protocols; Internet application protocols and applications: http; DNS; Web services; email protocols: SMTP, POP3; Network security. The students are expected to implement a project in the field of computer networks and to use open-source network simulators such as NS2.

Prerequisites: CE201

CE3561 Computer Networks Lab	1 Cr Hr (0,3)	ECTS
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Gain hands on experience on computer network protocols and interfaces, OSI reference model, and Internet protocols.

Prerequisites: CE201, CE352^{co}

CE441 Embedded System Design	3 Cr Hr (3,0)	ECTS
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Embedded system concepts, hardware architecture, design and debugging, embedded processor selection, software development methodologies, real-time Linux, synchronization mechanisms, interrupt latency, application programming interface, interrupt service routine, application design considerations.

Prerequisites: CE201

CE342 Microprocessor and Microcomputer Systems	3 Cr Hr (3,0)	ECTS
Introduction to theoretical concepts of 8-bit and 16-bit microprocessors including microprocessor architecture, memory organization, instruction set, input/output organization, and interrupts. Design of microcomputer systems, address maps, system bus, memory maps, peripheral I/O, memory-mapped I/O, interrupt-driven I/O, interface devices, and general-purpose programmable peripheral devices.		
<i>Prerequisites:</i> BSC001		
CE354 Computer Security	3 Cr Hr (3,0)	ECTS
Security of networked computer systems; secure network configuration and user management; handling of attacks; Tools for secure network management; System management; System administration; System programming for security; Security: local attacks; network attacks; Firewalls; Security of web servers, ftp servers and mail servers; Virtual private networks, Cryptography, encryption and decryption techniques, primary key and digital certificate principles, Public Key Cryptography and the RSA Algorithm.		
<i>Prerequisites:</i> BSC001		
CE355 Data Communication	3 Cr Hr (3,0)	ECTS
Fundamentals of Data Communications. Transmission Media, Data Encoding, Transmission Techniques, Protocols, Switching Networks, Broadcast Networks, Local Area Networks (LANs) and Wide Area Networks (WANs). Transmissions Technique and Cables. Troubleshooting Methods. Communication Interfaces. Network Security. Error Detection and Correction Methods. Modems Modulation Techniques for Digital Data Transmission, Data Link Protocols. High-Speed Packet Switching and Message Switching. OSI Reference Model. TCP/IP Protocols. Routing and Flow Control. Fundamentals of Frame Relay, ATM, X.25. Application Services, HTTP, Cryptography, MIME, E-mail. Telecommunication Services, ISDN, xDSL. New Technologies, IP Telephony, H323, WAP.		
<i>Prerequisites:</i> BSC001		
CE444 Microcomputer Interface and Peripheral Devices	3 Cr Hr (3,0)	ECTS
This course covers various topics relative to microprocessor/microcontroller interfacing in addition to peripheral devices and their properties. Topics include Processor Architecture Overview, Memory Models, GPIO interfacing, Interrupt handling, ADCs and DACs, Timers and PWM, Serial Interface Controllers, External sensor interfacing, Driving outputs. The course also has a practical part which uses Microcontrollers to conduct experiments based on assembly and the C language that interface with different input and output peripherals.		
<i>Prerequisites:</i> BSC001		
CE452 Network Protocols	3 Cr Hr (3,0)	ECTS
Topics include the TCP/IP networking protocol architectures, layering, encapsulation, PDUs; sliding window algorithms, flow and error control, and the HDLC and PPP protocols; the OSI network layer organization, virtual circuits and datagrams, routing and congestion control algorithms, the X.25 and Frame Relay protocols and, internetworking, IPv4 and the evolving IPv6 internetworking protocols, and the RIP, OSPF, ES-IS, and IS-IS routing protocols, session layer dialog control and activity management, queuing, , packet scheduling, network security protocols; IPsec and VPNs, performance analysis, testing, correctness, SNMP, Wireless network protocols, Multi-Protocol Label Switching (MPLS), multimedia and real time network protocols.		
<i>Prerequisites:</i> BSC001		
CE377 Machine Learning	3 Cr Hr (3,0)	ECTS
This course focuses on statistical pattern recognition and machine learning techniques. The main topics of the course include: Bayesian decision theory, parametric density estimation (Maximum likelihood estimation (MLE) and non-parametric density estimation (Density Estimation, Parzen Window, K- Nearest Neighbor estimation, PNN, k-Nearest Neighbor classification rule), Bayesian parameter estimation, Hidden Markov models (HMM)), Linear Discriminant Analysis(Linear discriminant functions, generalized discriminant analysis, Support vector machines), probabilistic graphical models, Multilayer Neural Networks (Perceptron Model, Artificial Neural Networks ANN's, Feed-forward NN, Error Back-propagation Algorithm), deep learning, and feature reduction and selection. This course involves several programming assignments in which students will use Matlab and/or Python to build various machine learning and pattern classification models that can be used to solve real-world problems		

in the fields of IoT applications, biomedical image and signal analysis, bioinformatics, among others.

Prerequisites: BSC001

CE521 Robotics	3 Cr Hr (3,0)	ECTS
Introduction to basics of modeling, design, planning, and control of robot systems. Topics include robotics foundations in kinematics, dynamics, control, motion planning, trajectory generation, programming, and design.		

Prerequisites: BSC001

CE552 Advanced Computer Networks	3 Cr Hr (3,0)	ECTS
High-speed local networks; metropolitan area networks; bridges; routers; gateways; TCP/IP; application services; IP addressing; IP forwarding, encapsulation, and fragmentation; Address Resolution (ARP& RARP); IP next generation (IPv6); Inter Control Message Protocol (ICMP). Routing Algorithms, MPLS networking technology, VPNs, Network applications and services, Multimedia over internet, Network performance, and Network design. A set of laboratory experiments will provide hands-on experience in related topics.		

Prerequisites: BSC001

CE561 Deep Learning	3 Cr Hr (3,0)	ECTS
This course provides a comprehensive introduction to deep neural networks. Topics include multilayer perceptions, convolutional neural networks, recurrent neural networks, deep unsupervised and reinforcement learning, practical aspects of training deep neural networks. Students will learn basic concepts of deep learning as well as hands on experience to solve real-life problems.		

Prerequisites: BSC001

CE563 Human Computer Interaction	3 Cr Hr (3,0)	ECTS
This course covers fundamental theories and concepts of human-computer interaction (HCI). Students will gain theoretical knowledge of and practical experience in the fundamental aspects of human perception, cognition, and learning as relates to the design, implementation, and evaluation of interfaces. Topics covered include interface design, usability evaluation, universal design, multimodal interfaces (touch, vision, and natural language), virtual reality, and spatial displays.		

Prerequisites: BSC001

CE564 Pattern Recognition	3 Cr Hr (3,0)	ECTS
This course provides a comprehensive introduction to pattern recognition This course covers the methodologies, technologies, and algorithms of statistical pattern recognition from a variety of perspectives. Topics including pattern recognition systems, preprocessing and feature extraction, theories of supervised and unsupervised learning, object classification and recognition, artificial neural networks, and other topics as well.		

Prerequisites: BSC001

CE565 Computer Vision	3 Cr Hr	ECTS
This course covers various algorithms and methods that enable a machine to understand images and videos. The topics covered in this course include image formation, feature detection, segmentation, multiple view geometry, camera geometry, 3-D reconstruction, recognition and learning, and video processing.		

Prerequisites: BSC001

CS116 Computing Fundamentals	3 Cr Hr (3,0)	ECTS
Basic computer skills, programming concepts, algorithms, variables and data types; arithmetic, logical, relational, Boolean, and assignment operators; simple input and output statements, selection structures, loop structures, single and multidimensional arrays, character strings, functions, data structures, pointers, input/output file operations.		

CS1160 Computing Fundamentals Lab	3 Cr Hr (3,0)	ECTS
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Lab session every week to offer hands-on experience on the topics that are covered in CS116, which are: algorithms, variables and data types; arithmetic, logical, relational, Boolean, and assignment operators; simple input and output statements, selection structures, loop structures, single and multidimensional arrays, character strings, functions, data structures, pointers, input/output file operations.

Prerequisites: CS116^{co}

CS117 Object Oriented Programming	3 Cr Hr (3,0)	ECTS
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Object Oriented Programming concepts; Classes, objects and data abstraction, Constructors, and destructors; Object-oriented design; encapsulation and information hiding; abstraction and modularization, coupling and cohesion, sample design patterns. inheritance; class and type hierarchies, polymorphism, Abstract classes, Interfaces; Packages; Collection classes, Generics, streams and files, exception handling; unit testing and debugging, Application Programming Interfaces, Javadoc, 3-hours lab session every week to enhance hands-on experience on topics that are theoretically covered in the course using the Java compiler on a Solaris/Sun environment.

Prerequisites: CS116, CS1160, ARB0099, ENGL0099, MATH0099

CS1170 Object Oriented Programming Lab	1 Cr Hr (0,3)	ECTS
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Lab session every week to enhance hands-on experience on topics that are theoretically covered in the course: Object Oriented Programming concepts; Classes, objects and data abstraction, Constructors, and destructors; Object-oriented design; encapsulation and information hiding; abstraction and modularization, coupling and cohesion, sample design patterns. Inheritance; class and type hierarchies, polymorphism, Abstract classes, Interfaces; Packages; Collection classes, Generics, streams and files, exception handling; unit testing and debugging, Application Programming Interfaces, Javadoc.

Prerequisites: CS117^{co}, CS116, CS1160, ARB099, ENGL099, MATH099

CS263 Database Management Systems	3 Cr Hr (2,2)	ECTS
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DBMS Architecture, Storage Hierarchy, Indexes, Entity-relationship (E-R) modeling, The relational model, Relational Query Language (SQL), Query processing and optimization, Creation and manipulation of databases; Indices and views; Access rights management; Programming in SQL; Transaction Processing (Transactional properties, Concurrency control, Locking, and Crash recovery); Data dictionaries; Required software tools: A main-stream commercial DBMS such as MS SQL, Oracle.

Prerequisites: BSC001

CS330 Image Understanding	3 Cr Hr	ECTS
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This course is an introduction to fundamental concepts in image understanding. This course explores several algorithms for extracting useful semantic content from image data. In general, the course theme spans over three main topics: image processing, features and matching, geometry in vision, and recognition. In particular, the course will include algorithms and techniques related to linear filters, edge detection, image pyramids, SIFT, Harris Corner detection, feature selection, camera models, homography, stereo vision, image search, fast retrieval, image classification, objection detection, HOG detector.

Prerequisites: BSC001

CS332 Computer Graphics	3 Cr Hr (2,2)	ECTS
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Basic concepts of computer graphics, general features of graphics hardware, raster graphics versus vector graphics, drawing primitive objects: lines, poly-lines, polygons, circles, ellipses, curves; filling methods: scan-line fill and flood fill; Basic two-dimensional (2D) geometric transformations: translation, rotation, scaling and reflection; 2D composite transformations, 2D viewing: clipping window and windowing transformation; basic three-dimensional (3D) geometric transformations: translation, scaling, rotation and reflection; composite 3D

geometric transformations, viewing a 3D scene: setting a 3D viewing coordinate reference, transformation from world to viewing coordinates; projection transformations, 3D object representations: lines, planes, polyhedral, curved surfaces, spheres, ellipsoids; visible-surface detection methods, illumination models and surface-rendering methods, shadow mapping, transparency and surface rendering, interactive graphics.

Prerequisites: BSC001

CS416 Systems Programming	3 Cr Hr (2,2)	ECTS
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System-level UNIX API's: Process manipulation; IO operations; Use of OS functionality; System-level programming in C; Shell programming; Unix system services: file system, process and thread management, inter-process communication: pipes, shared memory, and message queues, semaphores; Network programming, and synchronization; Microsoft Windows and UNIX TCP and UDP.

Prerequisites: BSC001

CS460 Data Mining	3 Cr Hr (3,0)	ECTS
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The course introduces students to data mining, by studying their principles, algorithms, implementation methodology, and applications. It provides a comprehensive introduction to data mining, including data selection, cleaning, coding, using different pattern recognition techniques, and reporting; and introduce students to the applications of data mining by using commercial tools for creating business applications.

Prerequisites: BSC001

CS4611 Big Data	3 Cr Hr (3,0)	ECTS
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The key objective of this course is to familiarize the students with most important information technologies used in manipulating, storing, and analyzing big data. The course includes introducing students to the basic tools for statistical analysis (e.g., R and Python) and also mastering big data processing frameworks (e.g., Hadoop and Spark). Furthermore, students will learn so-called NoSQL storage solutions exemplified by Cassandra for their critical features: speed of reads and writes, and ability to scale to extreme volumes. Students will learn about memory resident databases (VoltDB, SciDB) and graph databases (Ne4J).

Prerequisites: BSC001

CS357 Cybersecurity	3 Cr Hr	ECTS
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This course covers an essential range of topics for securing modern enterprises. Course topics include Cryptographic Tools, user authentication, database and cloud Security, malicious software, denial of service attacks, intrusion detection, firewalls and intrusion prevention systems, IT security management and risk assessment, human resources security, legal and ethical aspects, enterprise roles, security metrics, risk management, standards and regulations, physical security, and cybercrime issues and investigation.

Prerequisites: BSC001

IX. Courses offered by Other Schools

ARB0099 Elementary Arabic	3 Cr Hr (3,0)	3 ECTS
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This course aims to develop student's ability to read, comprehend, literary analyze, grammatically analyze, linguistically analyze, poetically analyze, and rhetorically analyze texts properly. The course also includes a selection of Arabic literature in poetry and prose representing different literary ages, in addition to several common forms of writing such as scientific article, news article, and others.

Prerequisites: Placement test

ARB100 Arabic	3 Cr Hr (3,0)	3 ECTS
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This course aims to improve the student's competence in the various linguistic skills in terms of reading, comprehension, and taste. This is achieved through the study of selected texts with many implications that raise issues in spelling, grammar, composition, meaning, and inference, and the use of an old and modern thesaurus.

Prerequisites: **ARB0099**

ENGL0098 Elementary English	3 Cr Hr (3,0)	3 ECTS
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Students will focus on English at an elementary level through the receptive skills of reading and listening and the productive skills of writing and speaking. English III is aimed at students who have achieved a grade of between 0 and 60 on the English Placement Test. This course is zero credit hours. This course enables students to contribute their own knowledge or experience in speaking activities, and use the language correctly. The exposure to a wide variety of listening material with a variety of accents, including some non-native speakers of English improves their level. English III integrates the focus on individual sounds of word and sentence stress where students are encouraged to copy the rhythm of English. Pronunciation is also integrated into Grammar and Vocabulary activities.

Prerequisites: Placement test

ENGL0099 Intermediate English	3 Cr Hr (3,0)	3 ECTS
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Students will focus on English at an intermediate level through the receptive skills of reading and listening and the productive skills of writing and speaking. English IV is aimed at students who have successfully passed English III or achieved a grade of between 61-80 on the English Placement Test. This course is zero credit hours. Attendance: Students are required to attend regularly according to the regulations of GJU and should provide the instructor with official excuses in case they are absent for a long time. Participation and homework: Students are required to participate in the group discussion in class. Interaction is necessary as well as oral presentations will be given to measure how fluent students are and to improve their skill of speaking. Medium of communication: GJU email, face to face (on campus) and during office hours. Teaching method: Explaining, discussing and doing the exercises given to students.

Prerequisites: **ENGL0098**

ENGL1001 Upper-Intermediate English	3 Cr Hr (3,0)	3 ECTS
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"Education is the ability to listen to almost anything without losing your temper or your self-confidence." Robert Frost (1874 - 1963) English V is aimed at students who have achieved a passing grade in English IV or a grade between 81 and above on the English Placement Test. English V is equal to three credit hours. Students will focus on English at an upper intermediate level. Students will analyze and produce essays with an emphasis on argumentation and persuasion working both independently and cooperatively to gather, evaluate, and synthesize necessary information. Class activities include interactive lectures, small group and class discussions, informal debates, peer feedback, individual presentations, focused listening exercises and focused viewing exercises as well as assorted reading, writing, and grammar assignments. There will be some poetry analysis together with reading and understanding a short story and a drama using basic literary terms and concepts. Note: The process of argumentation enables us to clarify and develop our own responses to important issues, and a significant part of that process involves dialogue with both those who share our opinions and those who do not. In order to participate responsibly and effectively in meaningful dialogue, we must maintain an attitude characterized by openness, responsibility, rationality, and respect for all participants. Upon finishing this level, all students are eligible to receive an English language proficiency letter indicating their level according to the

Common European Framework Reference for Languages (CEFR) varying between B1 and B2 according to the grade they get upon finishing this level.

Prerequisites: ENGL0099

ENGL1002 Advanced English	3 Cr Hr (3,0)	3 ECTS
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Advanced English, is the last of the English levels at the German Jordanian University to arm graduates with the best command of the English language in its varied aspects: Reading, Writing, Speaking, Listening and Understanding. It is aimed at students who successfully pass English V and it is three credit hours. This level focuses on a higher level of enhancement of their language. Students can address any audience, through delivering a persuasive speech, making an informative presentation, or analyzing controversial News through News Analysis. The students' Thesis Statements are backed up with: mistake-free language, persuasive logic and verified statistics, numbers and facts to convince the audience with their points of view. Other tools are enhanced involving their language, including specific terminology, tone, intonation and body language to make them acquire the best outcome. Students can also address any topic in writing. With the language skills provided in this level, GJU graduates become more equipped with outstanding abilities and get better chances in the work market, in addition to their knowledge and education in the major fields. The assessment of the students applies Bloom's Taxonomy where the learning objectives are classified according to the different domains including: learning (remembering), understanding, applying, analyzing, evaluating, the creating. Upon finishing this level, all students are eligible to receive an English language proficiency letter indicating their level according to the Common European Framework Reference for Languages (CEFR) varying between B2, C1 or C2 according to the grade they get upon finishing this level.

Prerequisites: ENGL1001

GERL101B1 German I B1-Track	3 Cr Hr (9,0)	6 ECTS
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Can understand and use familiar, everyday expressions and very simple sentences, which aim at the satisfaction of specific needs. Can introduce oneself, and others, and ask others questions to themselves - e.g. where they live, which people they know or what kind of things they have - and can give answers on questions of this kind. Can communicate on a basic level if those involved with him/ her in a conversation speak slowly and clearly and are willing to help.

GERL102B1 German II B1-Track	3 Cr Hr (9,0)	6 ECTS
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Can understand sentences and frequently used expressions if those are connected with things of immediate meaning (e.g., information to the person and to the family, buying, work, closer environment). Can communicate in simple, routine situations, with the purpose of a simple and direct exchange of information about familiar and common things. Can describe with simply means their own origin and training, direct environment and things that are in connection with direct needs.

Prerequisites: GERL101B1

GERL201B1 German III B1-Track	3 Cr Hr (6,0)	4 ECTS
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Can understand the main points if no dialect is used and if it concerns familiar things about work, school, spare time etc. Can master most situations, which one encounters on journeys in a German speaking area. Can express oneself simply and coherently about familiar topics and areas of personal interest. Can report experiences and events, describe dreams, hopes and goals and give short reasons or explanations about plans and opinions.

Prerequisites: GERL102B1 or GERL102B2, ARB0099, ENGL0099, MATH0099

GERL202B1 German IV B1-Track	3 Cr Hr (9,0)	6 ECTS
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Can understand the main contents of complex texts, as well as concrete and abstract topics; even discussions between specialists in his/ her own special field. Can communicate spontaneously and fluidly a normal discussion with native speakers, without larger effort on both sides. Can express oneself clearly, in detail in a broad spectrum of topics, describe a point of view to a current question, and indicate the pro and cons of different possibilities.

Prerequisites: GERL201B1 or GERL201B2, ARB0099, ENGL0099, MATH0099

GERL301B1 German V B1-Track	3 Cr Hr (9,0)	6 ECTS
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Can understand and seize implicit meanings of a broad spectrum of demanding, longer texts. Can express oneself spontaneously and fluidly, recognizing words without having to search for words frequently. Can use the language effectively and flexibly in social and vocational life or in training and study. Can express oneself clearly, structured and detailed, to complex subjects and use appropriate different means for linkage of texts.

Prerequisites: GERL202B1

GERL302B1 German VI B1-Track	3 Cr Hr (6,0)	6 ECTS
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German VI is a strongly practice-oriented course in preparation for your German Year. The course includes the modules "Intercultural Communication", "Job Application Training" and the technical languages. In part, it includes a special support program for students who did not achieve their language goal of a full B1 certificate in German V

BE302 Business Entrepreneurship	3 Cr Hr (3,0)	3 ECTS
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The course focuses on critical skills necessary to develop appropriate financing strategies for new venture creation and growth. Students will use case studies and team projects in course studies. Three primary topics are covered: first, an overview of the entrepreneurial finance process and involved players; second, performing business valuations; and third, securities law with emphasis on developing term sheets and private placement memorandums. Student teams will complete a valuation and mock securities offering for an existing small to mid-size business. Financial valuations and terms sheets developed by student teams will be presented to a panel of venture capital professionals for evaluation and critique.

Prerequisites: ENGL0099

DES101 Arts Appreciation	3 Cr Hr (3,0)	3 ECTS
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An introductory course designed for non-art students to give them the basic knowledge of arts and simple approaches to the understanding of the history, development, elements, criticism, esthetics and materials of different art forms (visual, aural and performing arts). A comparative approach between the different arts is given to enhance the students' global understanding of arts and to give them the ability to look at art works and form their own opinions. The course is combined with examples of audio and visual arts.

Prerequisites: ARB0099, ENGL0099

EI101 Leadership and Emotional Intelligence	3 Cr Hr (3,0)	3 ECTS
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In this course, students will be introduced to the concept of Emotional Intelligence as a means to improve self-management and relationship management. The operative concepts are applied to social, family, academic and professional relationships with an emphasis on leadership implications. The majority of the curriculum is based upon the book by Daniel Goleman entitled: "Leadership: The Power of Emotional Intelligence," and covers leadership styles and their appropriate applications, the emotional intelligence model, and neurological aspects of the limbic system. The class is a lecture format which encourages student participation.

Prerequisites: ENGL0099

IC101 Intercultural Communication	3 Cr Hr (3,0)	3 ECTS
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This course is designed to provide prospective students (whose majors have an international flavor) with tools that offer powerful possibilities for improving the communication process. We will examine the process of sending and receiving messages between people whose cultural background could lead them to interpret verbal and nonverbal signs differently. We will learn about the diversity of these cultural differences and at the same time learn how we might overcome them. Our efforts to recognize and surmount cultural differences will hopefully open up business opportunities throughout the world and maximize the contribution of all the employees in a diverse workforce.

Prerequisites: ENGL0099

MILS100 Military Science	3 Cr Hr (3,0)	3 ECTS
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History of the Jordanian Arab Army. United Nations Peace Keeping Forces. Preparation of the nation for defense and liberation. History of the Hashemite Kingdom of Jordan and its development

Prerequisites:

NE101, NEE101 National Education	3 Cr Hr (3,0)	3 ECTS
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In a context of striving towards democracy like the one Jordan enjoys today, the meaning and practice of active and responsible citizenship becomes more crucial. It is often argued that democracy requires “democrats” to flourish and become well established. Democrats are those women and men who recognize pluralism, inclusion, positive engagement, and participation as the main values that govern their interaction with the state as citizens and with each other as diverse people of different interests. In this course you will be able to understand your rights and responsibilities as Jordanian citizen expand your knowledge about the frameworks, and processes that regulates citizen-state relationships as well as the basic necessary skills for you to practice your citizenship rights in a civic manner.

Prerequisites:

PE101 Sports and Health	3 Cr Hr (3,0)	3 ECTS
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The course focuses on providing students with information related to Sport, fitness and health culture, Voluntary work Nutrition, First Aid. It covers also Special physical preparation and general sports cultural issues.

Prerequisites: ARB0099

SE301 Social Entrepreneurship and Enterprises	3 Cr Hr (3,0)	3 ECTS
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This course will serve as an introduction to the field of social entrepreneurship and social enterprises. Through lectures, field visits, analyses of relevant literature, case studies and exercises, this course will explore social entrepreneurship’s potentials, opportunities and limitations. The topics will cover Defining Social Entrepreneurship. Contextualizing Social Entrepreneurship (need, motives, forms, criteria). Role of Leadership, Creativity and Innovation. Locating SE on the profit/non-profit continuum. SE in the larger fields of development, social change, community activism. Social Enterprises (Missions, Markets, Finances). Ethical business and corporate social responsibility.

Prerequisites: ENGL0099

SFTS101 Soft Skills	3 Cr Hr (3,0)	3 ECTS
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This course is designed to help develop strong oral and written communication skills. The student will be given opportunities to practice writing and editing professional correspondence and technical reports. Additionally, the student will compose and deliver oral presentations. Assignments will include the use of inductive and deductive approaches to conveying a variety of messages. The course emphasis the use of software tools to prepare presentations, stress management, confidence, and sensitivity to others. It also stresses on resume writing and conducting interviews.

Prerequisites: ENGL0099

TW303 Technical and Workplace Writing	3 Cr Hr (3,0)	3 ECTS
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Technical and Workplace Writing course focuses on essentials; it introduces students to professional and technical writing through a straightforward structure, adding knowledge while practicing different forms and skills. Since this course is a practical one, the course offers the "how" (instructions) and the "what" (examples) with discussion topics and exercises designed to make instruction straightforward. Students are exposed to certain genres, such as web page design, summaries, proposals, user guides, and job application materials. This is why this course is designed with a student/worker in mind, who would greatly benefit from the techniques of writing presented throughout the course.

Prerequisites: ENGL0099

MATH0099 Pre-Math	3 Cr Hr (3,0)	3 ECTS
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This course is intended as a preparation for Calculus MATH101 with a focus on functions and algebraic techniques preparatory to Calculus. The functions studied include polynomial, rational functions, exponential and logarithmic functions, and trigonometric functions along with analytic trigonometry.

F2F: Face-to-face

BLD: Blended

OL: Online

co: Corequisite

MATH101 Calculus I **3 Cr Hr (3,0)** **5 ECTS**

This course introduces the student to the calculus of single-valued functions. Topics include limits, continuity, rates of change, rules for differentiating, differentials and local linear approximations, maxima and minima problems, L'Hôpital's rule, related rates, logarithmic and implicit differentiation, inverse trigonometric and hyperbolic functions, Rolle's theorem, the mean-value theorem, and applications of derivatives and integrals

Prerequisites: **MATH0099**

MATH102 Calculus II **3 Cr Hr (3,0)** **5 ECTS**

This is a course in multivariate calculus as a continuation of Calculus I. The course focuses on power series, polar coordinates and polar functions, sequences and infinite series, vectors, functions of several variables and their limits, partial differentiation and their applications. The course views multiple integrals: double and triple, line integrals, surface integrals, Green's theorem, Gauss's divergence theorem, and Stoke's theorem.

Prerequisites: MATH101

MATH203 Applied Mathematics for Engineers **3 Cr Hr (3,0)** **5 ECTS**

Vector analysis in Cartesian coordinates; Curvilinear coordinates and transformations to Cartesian, Spherical, and Cylindrical coordinates; line integrals, surface integrals, Green's theorem, Gauss's divergence theorem, and Stokes's theorem. Scalar and vector potential. Review of Series. Linear Algebra; Matrices and linear equations; Matrices and Linear Operators; Determinants, Eigenvalues and eigenvectors. Complex Numbers and Complex Variable; Representation of complex numbers, DeMoivre's formula, Powers and roots of complex numbers, Functions of complex variable.

Prerequisite: MATH102, ARB099, ENGL099

MATH205 Differential Equations **3 Cr Hr (3,0)** **5 ECTS**

First-order ordinary differential equations, Second-order ordinary differential equations, System of ODEs. Solution Techniques including Laplace transforms, Fourier series: eigenvalue problems and expansions in orthogonal functions. Partial differential equation: classification, separation of variables, solution by series and transform methods. Models in Applied Mathematics; Applications to illustrate typical problems and methods of applied mathematics in solid and fluid mechanics, fields of physics, dynamics and vibrations, wave phenomena, diffusion phenomena, heat conduction, and biological processes.

Prerequisite: MATH102, ARB099, ENGL099

PHYS103 Physics I **3 Cr Hr (3,0)** **5 ECTS**

Physics and measurement. Motion in one dimension. Vectors. Motion in two dimensions. Force and motion. Kinetic energy and work. Potential energy and conservation of energy. Linear momentum and collisions. Rotation. Rolling and angular momentum.

Prerequisites:

PHYS104 Physics II **3 Cr Hr (3,0)** **5 ECTS**

Electric Fields. Gauss's Law. Electric Potential. Capacitance and Dielectrics. Current and Resistance. Direct Current Circuits. Magnetic Fields. Sources of Magnetic Field. Faraday's Law.

Prerequisites: PHYS103

PHYS106 General Physics Lab **1 Cr Hr (0,3)** **ECTS**

Developing a good understanding of a few important concepts in Mechanics, Electricity, and Magnetism. Learning to apply these concepts to familiar and unfamiliar situations and gaining the ability to reason qualitatively and quantitatively. This lab consists of 12 experiments, six in Mechanics and six in Electricity and Magnetism.

Prerequisites: PHYS103, PHYS104^{co}

CHEM103 General Chemistry	3 Cr Hr (3,0)	ECTS
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Stoichiometry of formulas and equations. Gases and the kinetic-molecular theory. Quantum theory and atomic structure. The components of matter. The major classes of chemical reactions (precipitation, acid-base, oxidation-reduction, and reversible reactions). Thermodynamics: energy flow and chemical change. Quantum theory and atomic structure. Electron configurations and chemical periodicity. Kinetics: rates and mechanisms of chemical reactions. Equilibrium: The extent of chemical reactions. Acid-base equilibria.

Prerequisites:

BM371 Numerical Methods for Engineers	3 Cr Hr (3,0)	ECTS
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Fundamentals of error analysis, numerical solutions of linear and nonlinear equations, numerical solution of system of equations, curve fitting, numerical integration and differentiation, numerical solution of ordinary differential equations. Application of numerical methods using relevant software packages.

Prerequisites: MATH203, MATH205, CS116

IE0141 Engineering Workshops	1 Cr Hr (0,3)	ECTS
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General safety, materials, and their classifications, measuring devices and their accuracy, basic household plumbing and electricity, fits and tolerances, theoretical background for the practical exercises including fitting, forging, carpentry, casting, welding, mechanical saws, shearers, drills, lathes, milling machines, shapers, and grinders.

Prerequisites:

ME0344 Control Systems I	3 Cr Hr (3,0)	ECTS
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This course introduces control systems: history, design process, computer-aided-design. Mechanical, electrical, and electro-mechanical systems modeling in the frequency domain: Laplace, transfer function, and linearization. System modeling in the time domain: state space, transfer function conversion. The time response: poles and zeros, first and second order systems. Stability: Routh-Hurwitz Criterion. Root locus techniques, and Frequency response techniques. Control system design using root locus techniques including Proportional (P), Proportional-Derivative (PD), Proportional-Integral (PI), and Proportional-Integral-Derivative (PID) controllers.

Prerequisites: CE331, EE361

ME0345 Control and Vibration Lab	1 Cr Hr (0,3)	ECTS
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Lab assignments will offer students practical experience with several physical experimental setups designed to teach the principals of free vibration of simple mass-spring systems, free damped response of simple mass-spring damper systems, harmonically excited systems, frequency response of the harmonically excited systems, frequency response with base excitation, introduction to Control, PID Controllers, simple and inverted pendulum control, fluid level and temperature control, and twin rotor control. Simulation and design of control systems using MATLAB will also be covered in the lab.

Prerequisites: CE331, EE361, ME0343^{co}