



الجامعة الألمانية الأردنية  
German Jordanian University

**German Jordanian University**

**School of Sustainable Systems and Engineering (SSSE)**

**Department of Electrical and Energy Engineering**

**Bachelor of Science in Electrical Engineering**

**Study Plan 2022**

## **I. Program Vision**

To be a recognized department of electrical engineering in producing highly qualified engineers who are capable of finding effective solutions to emerging problems related to society, environment, and industry by employing trending and innovative technologies.

## **II. Program Mission**

To arm students with the required knowledge, technical skills, and experience in the field of electrical engineering that enables them to fulfill society and market needs.

## **III. Program General Description**

The department of electrical engineering (EE) at GJU was established in 2009 and offers a Bachelor of Science (B.Sc.) degree in EE. The B.Sc. degree in EE requires successful completion of 174 credit hours (Cr Hrs) distributed among five years. Additionally, a local practical training of not less than 160 practical hours is required. Furthermore, the students are required to complete a full academic year in Germany. The 174 Cr Hrs are divided as follows: 21 Cr Hrs represent compulsory university requirements, 6 Cr Hrs represent elective university requirements, 26 Cr Hrs compulsory school requirements, 109 Cr Hrs compulsory program requirements, and finally, 12 Cr Hrs elective program requirements.

While the majority of public and private universities in Jordan offer a B.Sc. degree in electrical engineering, the EE program at GJU is unique as it provides knowledge of electrical engineering principles along with the required supporting knowledge in a wide spectrum of specializations including: telecommunications, power engineering, electronic engineering, and computer engineering. Based on the student interest and passion as well as the job-market needs, EE students can easily shape and tailor their skills and experience by taking various elective courses. Furthermore, EE students at GJU have to spend one year (fourth or fifth year) in Germany as part of their bachelor's degree. This year is divided into two semesters. In the first semester, students register for 12 credit hours of elective courses at one of our German partner universities. In the second semester, they train in German industry for 5 months. Additionally, the EE program gives its students the opportunity to conduct their graduation projects in Germany. The EE department offers several laboratory facilities that enable students to design, conduct experiments, analyze data, and verify advanced theoretical concepts.

The Department of Electrical Engineering at GJU offers a degree in Electrical Engineering in the following three tracks:

- Track 1: General Electrical Engineering.
- Track 2: 5G and Internet of Things (IoT).

5G is the 5th generation mobile network standard after 1G, 2G, 3G, and 4G networks. 5G is designed to enable seamless virtual connection of almost everyone to everything. Such connections include devices, machines, objects, and persons. 5G is supposed to boost the data rate to multi-Gbps speeds, and promises ultra-low latency, enhanced reliability, massive network capacity, and increased availability. According to recent market analysis, the global 5G Services Market size is expected to grow from \$53.0 billion in 2020 to \$249.2 billion by 2026. Also, the transformation to the 5G ecosystem is expected to witness 3–4 times faster growth rate than other connectivity transformations. It is also anticipated that 5G will witness rapid development worldwide in the coming few years, which creates several career opportunities and new industries.

IoT is defined by IEEE as: A network of networks where, typically, a massive number of objects, things, sensors, or devices are connected through communications and information infrastructure to provide value-added services via intelligent data processing and management for different applications (e.g., smart cities, smart health, smart grid, smart home, smart transportation, and smart shopping). CISCO stated that IoT is the next evolution of the Internet, connecting the unconnected people, processes, data, and things in any

business today. The number of Internet connected devices is expected to reach 25 billion in 2030 and the IoT revenue will reach \$1.5 Trillion in 2030 growing from \$500 Billion in 2019.

#### **IV. 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 a basic knowledge of electrical engineering principles along with the required supporting knowledge of mathematics, science, computing, and engineering fundamentals.
- 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 the local society.
- Succeed in the professional practice of engineering or related field.
- Pursue life-long learning through higher education and professional membership.

#### **V. 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

## VI. Framework for B.Sc. Degree (Credit Hours)

Classification	Credit Hours			ECTS		
	Compulsory	Elective	Total	Compulsory	Elective	Total
University Requirements	21	6	27	31	6	37
School Requirements	26	0	26			
Program Requirements	109	12	121			
<b>Total</b>	<b>156</b>	<b>18</b>	<b>174</b>	<b>00</b>	<b>00</b>	<b>00</b>

### 1. University Requirements: (27 credit hours)

#### 1.1 Prerequisite courses (6 credit hours)

Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Prerequisites / Co-requisites
				Lect	Lab	
ARB099	Arabic 99 <sup>a</sup>	0	0	3	-	-
ENGL099	English II <sup>a</sup>	0	0	3	-	-
<b>Total</b>		<b>0</b>	<b>0</b>	<b>6</b>	<b>0</b>	

<sup>a</sup> Not required for students who pass placement test

#### 1.2 Compulsory Courses: (21 credit hours)

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lect	Lab	
ARB100	Arabic	3	3	Online	3	-	ARB099
ENGL101	English III	1	3	Face_to_Face	3	-	ENGL099
ENGL102	English IV	1	3	Face_to_Face	3	-	ENGL101
ENGL201	English V	2	3	Face_to_Face	3	-	ENGL102, ARB099
ENGL202	English VI	2	3	Face_to_Face	3	-	ENGL201
GERL101B1	German I B1 track	3	6	Face_to_Face	9	-	-
GERL102B1	German II B1 track	3	6	Face_to_Face	9	-	GERL101B1
GERL102B2	German II B2 track	3	6	Face_to_Face	9	-	GERL101B1
MILS100	Military Science	3	2	Online	3	-	-
NE101	National Education	3	2	Online	3	-	-
NEE101	National Education (English)						
<b>Total</b>		<b>21</b>	<b>31</b>		<b>39</b>	<b>0</b>	

### 1.3 Elective Courses: (6 Credit Hours) (Two courses out of the following)

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lect	Lab	
BE302	Business Entrepreneurship	3	3	Online	3	-	ENGL101
DES101	Arts' Appreciation	3	3	Online	3	-	ENGL101, ARB099
EI101	Leadership and Emotional Intelligence	3	3	Online	3	-	ENGL101
IC101	Intercultural Communications	3	3	Online	3	-	ENGL101
PE101	Sports and Health	3	3	Online	3	-	ARB099
SE301	Social Entrepreneurship and Enterprises	3	3	Online	3	-	ENGL101
SFTS101	Soft Skills	3	3	Online	3	-	ENGL101
TW303	Technical and Workplace Writing	3	3	Online	3	3	ENGL102
<b>Total</b>		<b>6</b>	<b>6</b>		<b>6</b>	<b>0</b>	

## 2. School Requirements (26 Credit Hours)

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lect	Lab	
EE317	Linear Algebra	3		Blended	3	-	MATH102
CE212	Digital Systems	3		Face_to_Face	3	-	CS116, ARB099, ENGL099, MATH099
CE2120	Digital Systems Lab	1		Blended	0	3	Co-requisite: CE212
CE352	Computer Networks	3		Blended	3	-	CS116, CE201
CS116	Computing Fundamentals	3		Face_to_Face	3	-	
CS1160	Computing Fundamentals Lab	1		Blended	3	-	Co-requisite: CS116
GERL201B1	German III B1 track	3	4	Face_to_Face	6	-	-GERL102B1, ARB099, ENGL099 - GERL102B2, ARB099, ENGL099
OR	OR						
GERL201B2	German III B2 track	3	4		6	-	
GERL202B1	German IV B1 track	3	6	Face_to_Face	9	-	GERL201B1 GERL201B2
GERL202B2	German IV B2 track	3	6			9	
MATH099	Pre-Math	0		Blended	3	-	
MATH101	Calculus I	3		Blended	3	-	MATH099*
MATH102	Calculus II	3		Face_to_Face	3	-	MATH101
<b>Total</b>		<b>26</b>	<b>0</b>		<b>0</b>	<b>0</b>	

\* Placement test

### 3. Program Requirements (121 credit hours)

#### 3.1 Compulsory Courses (109 Credit Hours):

##### 3.1.1 Compulsory Courses for all Tracks (99 Credit Hours)

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lecture	Lab	
EE241	Electronics 1	3		Face_to_Face	3	0	ENE211
EE2410	Electronics 1 Lab	1		Blended	0	3	ENE213, Co-requisite: EE241
EE315	Probability, Statistics and Random Processes	3		Blended	3	0	Co-requisite MATH102
EE321	Communication Systems I	3		Blended	3	0	CE331
EE3210	Communication Systems I Lab	1		Blended	0	3	Co-requisite EE321
EE322	Communication Systems II	3		Blended	3	0	EE321, Co-requisite EE315, EE317
EE3220	Communication Systems II Lab	1		Blended	0	3	Co-requisite EE322
EE333	Electromagnetics	3		Face_to_Face	3	0	MATH203
EE343	Digital Electronics	3		Face_to_Face	3	0	EE241
EE3430	Digital Electronics Lab	1		Blended	0	3	Co-requisite EE343
EE361	Modeling and Simulation of Electrical Systems	1		Blended	0	3	CE331
EE393	Field Training	0		Blended	0	0	Department approval
EE492	Senior Project I	1		Blended	-	-	Department approval
EE493	International Internship	12		Blended	0	36	Department approval
EE594	Senior Project II	3		Online	-	-	EE492
BM371	Numerical Methods for Engineers	3		Blended	2	0	MATH203, MATH205, CS116
BM3710	Numerical Methods for Engineers Lab	0		Blended	0	3	BM371
CE201	Computer Architecture and Organization	3		Face_to_Face	3	0	CE212, CE2120
CE331	Signals and Systems	3		Blended	3	0	MATH203
CE3561	Computer Networks Lab	1		Blended	0	3	Co-requisite: CE352
CE441	Embedded System Design	3		Face_to_Face	3	0	CE201

CHEM103	General Chemistry	3		Face_to_Face	3	0	
CS214	Object Oriented Programming	3		Face_to_Face	3	0	CS116, CS1160, ARB099, ENGL099, MATH099
CS2140	Object Oriented Programming Lab	1		Blended	0	3	Co-requisite: CS214
ENE211	Electrical Circuits I	3		Face_to_Face	3	0	PHYS104, ARB099, ENGL099, MATH099
ENE212	Electrical Circuits II	3		Face_to_Face	3	0	ENE211
ENE213	Electrical Circuits Lab	1		Blended	0	3	ENE211
ENE311	Electrical Machines	3		Face_to_Face	3	0	ENE212, EE333
ENE313	Electrical Machines Lab	1		Blended	0	3	Co-request ENE311
ENE415	Power Systems	3		Face_to_Face	3	0	ENE311
GERL301	German V	3		Face_to_Face	6	0	GERL202
GERL302	German VI	3		Face_to_Face	9	0	GERL301
IE121	Engineering Workshop	1		Face_to_Face	0	3	
MATH203	Applied Mathematics for Engineers	3		Face_to_Face	3	0	MATH102, ARB099, ENGL099
MATH205	Differential Equations	3		Face_to_Face	3	0	MATH102, ARB099, ENGL099
ME0111	Computer Aided Engineering Drawing	2		Blended	0	6	CS116
ME343	Automatic Control Systems	3		Blended	3	0	CE331
ME3430	Automatic Control Systems Lab	1		Blended	0	3	Co-requisite ME343
PHYS103	Physics I	3		Blended	3	0	
PHYS104	Physics II	3		Face_to_Face	3	0	PHYS103
PHYS106	Physics Lab	1		Blended	0	3	Co-requisite: PHYS104
<b>Total Credit Hours</b>		<b>99</b>					

\* The EE391 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 EE592 Senior project I course should be registered after completing the EE391 course

### 3.1.2 Compulsory Courses for General EE Track (10 Credit Hours):

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lecture	Lab	
EE342	Electronics II	3		Face_to_Face	3	0	EE241
EE510	Wireless and Mobile Communications	3		Face_to_Face	3	0	EE315
EE541	Electronic Communication Circuits	3		Face_to_Face	3	0	EE241, EE321
EE5410	Electronic Communication Circuits Lab	1		Blended	0	3	Co-requisite EE541

### 3.1.3 Compulsory Courses for 5G and IoT Track (10 Credit Hours):

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lecture	Lab	
EE371	IoT Architecture and Protocols	3		Blended	3	0	CE352
EE570	Cloud Computing and Big Data	3		Face_to_Face	3	0	Co-requisite CE352
EE521	5G	3		Face_to_Face	3	0	EE321, Co-requisite EE5210
EE5210	5G Lab	1		Blended	0	3	Co-requisite EE521

### 3.2 Elective Courses (12 Credit Hours):

A minimum of 12 credit hours of engineering coursework are required. All lists are open for modifications based on school council decisions.

#### 3.2.1 Elective Courses for the General EE Track (12 Credit Hours):

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lect	Lab	
EE371	IoT Architecture and Protocols	3		Blended	3	0	EE493
EE461	Digital Signal Processing	3		Blended	3	0	EE493
EE570	Cloud Computing and Big Data	3		F2F	3	0	EE493
EE511	Satellite Communication Systems	3		Blended	3	0	EE493
EE514	Multimedia Communications	3		Blended	3	0	EE493
EE521	5G	3		Face_to_Face	3	0	EE493
EE531	Antennas	3		Blended	3	0	EE493
EE532	RF and Microwave Engineering	3		Blended	3	0	EE493
EE551	Optical Fiber Communications	3		Blended	3	0	EE493
EE560	Entrepreneurship in Electrical Engineering	3		Blended	3	0	EE493
EE561	Areas of Future Research in Electrical Engineering	3		Blended	3	0	EE493
EE562	Wireless Sensor Networks	3		Blended	3	0	EE493
EE572	Special Topics in Artificial Intelligence of Things	3		Blended	3	0	EE493
EE573	Special Topics in Smart Systems	3		Blended	3	0	EE493
EE574	Special Topics of Emerging Communication Systems	3		Blended	3	0	EE493
EE595	Special Topics in Electrical Engineering	3		Blended	3	0	EE493
EE596	Special Topics in Power Systems	3		Blended	3	0	EE493
EE597	Special Topics in Communication Engineering	3		Blended	3	0	EE493
EE598	Special Topics in Electronics	3		Blended	3	0	EE493
EE599	Special Topics in Signal Processing	3		Blended	3	0	EE493
CE342	Microprocessor and Microcomputer Systems	3		Face_to_Face	3	0	EE493
CE354	Computer Security	3		Blended	3	0	EE493
CE355	Data Communications	3		Blended	3	0	EE493
CE444	Microcomputer Interface and Peripheral Devices	3		Blended	3	3	EE493
CE452	Network Protocols	3		Face_to_Face	3	0	EE493
CE461	Image Processing	3		Blended	3	0	EE493
CE477	Machine learning	3		Face_to_Face	3	0	EE493
CE521	Robotics	3		Blended	3	0	EE493
CE552	Advanced Computer Networks	3		Blended	3	0	EE493
CE561	Deep Learning	3		Face_to_Face	3	0	EE493
CE563	Human Computer Interaction	3		Face_to_	3	0	EE493

				Face			
CS330	Image Understanding	3		Face_to_Face	2	2	EE493
CS332	Computer Graphics	3		Face_to_Face	2	2	EE493
CS363	Database Management Systems	3		Blended	2	2	EE493
CS416	Systems Programming	3		Face_to_Face	2	2	EE493
CS460	Data Mining			Face_to_Face	3	0	EE493
CS461	Big Data	3		Face_to_Face	2	2	EE493
ENE433	Solar Energy I	3		Blended	3	0	EE493
ENE516	Smart-Grids	3		Blended	3	0	EE493
ENE517	Power Systems Protection	3		Blended	3	0	EE493
ENE518	High Voltage Engineering	3		Blended	3	0	EE493
ENE530	Advanced Renewable Energy Systems	3		Blended	3	0	EE493
ENE537	Energy Efficiency, Management and Laws	3		Blended	3	0	EE493
ENE547	Power System Stability	3		Blended	3	0	EE493

### 3.2.2 Elective Courses for the 5G and IoT Track (12 Credit Hours):

Course ID	Course Name	Credit Hours	ECTS	Teaching method	Contact Hours		Prerequisites / Co-requisites
					Lect	Lab	
EE511	Satellite Communication Systems	3		Blended	3	0	EE493
EE514	Multimedia Communications	3		Blended	3	0	EE493
EE532	RF and Microwave Engineering	3		Blended	3	0	EE493
EE544	Sensors and Actuators	3		Blended	3	0	EE493
EE551	Optical Fiber Communications	3		Blended	3	0	EE493
EE562	Wireless Sensor Networks	3		Blended	3	0	EE493
EE571	Industrial IoT	3		Blended	3	0	EE493
EE572	Special Topics in Artificial Intelligence of Things	3		Blended	3	0	EE493
EE573	Special Topics in Smart Systems	3		Blended	3	0	EE493
EE574	Special Topics of Emerging Communication Systems	3		Blended	3	0	EE493
EE575	Special Topics in Radio Access Technologies	3		Blended	3	0	EE493
EE576	Special Topics in Wireless Energy Management	3		Blended	3	0	EE493
EE577	Special Topics in Software Defined Networks	3		Blended	3	0	EE493
EE578	Special Topics in Device-to-Device Communications	3		Blended	3	0	EE493
EE580	Special Topics in IoT Management and Automation	3		Blended	3	0	EE493
EE582	Special Topics in IoT Devices	3		Blended	3	0	EE493
EE583	Special Topics in IoT Software Application Development	3		Blended	3	0	EE493
EE584	Special Topics in IoT Electronics	3		Blended	3	0	EE493
EE585	Special Topics in IoT Communications	3		Blended	3	0	EE493
EE586	Special Topics in IoT System Design	3		Blended	3	0	EE493
EE587	Special Topics in IoT Enabling Technologies	3		Blended	3	0	EE493
EE588	Special Topics in IoT Applications	3		Blended	3	0	EE493
EE589	Special Topics in IoT Energy Management	3		Blended	3	0	EE493
EE595	Special Topics in Electrical Engineering	3		Blended	3	0	EE493
EE597	Special Topics in Communication Engineering	3		Blended	3	0	EE493
CE444	Microcomputer Interface and Peripheral Devices	3		Blended	3	3	EE493
CE477	Machine learning	3		Face_to_Face	3	0	EE493
CE552	Advanced Computer Networks	3		Blended	3	0	EE493
CS363	Database Management Systems	3		Blended	2	2	EE493
CS460	Data Mining			Face_to_Face	3	0	EE493
CS461	Big Data	3		Face_to_Face	2	2	EE493

VII. Study Plan Guide for the Bachelor Degree in Electrical Engineering <sup>c</sup>

First Year				
First Semester				
Course ID	Course Name	Cr Hr	Prerequisites	Co-requisite
ARB100	Arabic	3	ARB99	
CS116	Computing Fundamentals	3		
CS1160	Computing Fundamentals Lab	1		CS116
ENGL1 01	English III	1	ENGL099	
GERL 101	German I	3		
MATH101	Calculus I	3	MATH099	
PHYS103	Physics I	3		
	University Elective Course	3		
	<b>Total</b>	<b>20</b>		

First Year				
Second Semester				
Course ID	Course Name	Cr Hr	Prerequisites	Co-requisite
CHEM103	General Chemistry	3		
CS214	Object Oriented Programming	3	CS116, CS1160	
CS2140	Object Oriented Programming lab	1		CS214
ENGL1 02	English IV	1	ENGL101	
GERL 102	German II	3	GERL101	
MATH102	Calculus II	3	MATH101	
ME0111	Computer Aided Engineering Drawing	2	CS116	
PHYS104	Physics II	3	PHYS103	
PHYS106	Physics Lab	1		PHYS104
	<b>Total</b>	<b>20</b>		

<sup>c</sup> The following study plan guide assumes having passed all placement tests

Second Year				
First Semester				
Course ID	Course Name	Cr Hr	Prerequisites	Co-requisite
ENGL201	English V	2	ENGL102	
GERL201	German III	3	GERL102	
CE212	Digital Systems	3		
CE2120	Digital Systems Lab	1		CE212
MATH203	Applied Mathematics for Engineers	3	MATH102	
ENE211	Electrical Circuits I	3	PHYS104	
ENE213	Electrical Circuits Lab	1		ENE211
IE121	Workshop	1		
	University Elective Course	3		
	<b>Total</b>	<b>20</b>		

Second Year				
Second Semester				
Course ID	Course Name	Cr Hr	Prerequisites	Co-requisite
CE201	Computer Architecture and Organization	3	CE212, CE2120	
CE331	Signals and Systems	3	MATH102	
ENE212	Electrical Circuits II	3	ENE211	
ENGL202	English VI	2	ENGL201	
GERL202	German IV	3	GERL201	
EE315	Probability, Statistics and Random Processes	3	MATH102	
MATH205	Differential Equations	3	MATH102	
	<b>Total</b>	<b>20</b>		

Third Year				
First Semester				
Course ID	Course Name	Cr Hr	Prerequisites	Co-requisite
CE352	Computer Networks	3	CE201, CS116	
EE241	Electronics 1	3	ENE211	
EE2410	Electronics 1 Lab	1	ENE213	EE241
EE317	Linear Algebra	3	MATH102	
EE321	Communication Systems I	3	CE331	
EE3210	Communication Systems I Lab	1		EE321
EE333	Electromagnetics	3	MATH203	
GERL301	German V	3	GERL202	
	<b>Total</b>	<b>20</b>		

Third Year				
Second Semester				
Course ID	Course Name	Cr Hr	Prerequisites	Co-requisite
BM371	Numerical Methods for Engineers	3	MATH203, MATH205, CS116	
BM3710	Numerical Methods for Engineers Lab	0		BM371
CE3561	Computer Networks Lab	1		CE352
EE361	Modeling and Simulation of Electrical Systems	1	CE331	
EE391	Field Training	0	Department Approval	
EE322	Communication Systems II	3	EE321	EE315, EE317
EE3220	Communication Systems II Lab	1		EE322
ENE311	Electrical Machines	3	ENE212, EE333	
ENE313	Electrical Machines Lab	1		ENE311
GERL302	German VI	3	GERL301	
EE342	Electronics II (EE Track)	3	EE241	
EE371	IoT Architecture and Protocols (5G & IoT Track)	3	EE352	
	<b>Total</b>	<b>19</b>		

Fourth Year				
First Semester				
Course ID	Course Name	Cr Hr	Prerequisites	Co-requisite
	Program Elective Course	3		
	Program Elective Course	3		
	Program Elective Course	3		
	Program Elective Course	3		
<b>Total</b>		<b>12</b>		

Fourth Year				
Second Semester				
Course ID	Course Name	Cr Hr	Prerequisites	Co-requisite
EE493	International Internship 6 Months Industry intern in Germany	12		
<b>Total</b>		<b>12</b>		

**German year prerequisites are:**

1. A minimum GPA of 61.0%
2. Successful completion of 90 credit hours excluding all German language courses
3. Passing GERL302 German VI and B1 German language test (all 4 language skills) conducted by Goethe Institute or another approved provider
4. ENGL201 English V, and Arabic 99
5. Passing two out of the three following courses:
  - EE321 Communication Systems I
  - CE352 Computer Networks
  - ENE311 Electrical Machines

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<sup>d</sup> Courses attended and/or passed during International Internship are not transferable

Fifth Year				
First Semester				
Course ID	Course Name	Cr Hr	Prerequisites	Co-requisite
CE441	Embedded System Design	3	CE201	
EE343	Digital Electronics	3	EE241	
EE3430	Digital Electronics Lab	1		EE343
EE492	Senior Project I	1	Department approval	
EE510	Wireless and Mobile Communications (EE Track)	3	EE315	
EE541	Electronic Communication Circuits (EE Track)	3	EE321, EE241	
EE5410	Electronic Communication Circuits Lab (EE Track)	1		EE541
EE521	5G (5G Track)	3	EE321	
EE5210	5G Lab	1		EE521
EE570	Cloud Computing and Big Data (IoT Track)	3		CE352
	<b>Total</b>	<b>15</b>		

Fifth Year				
Second Semester				
Course ID	Course Name	Cr Hr	Prerequisites	Co-requisite
EE594	Senior Project II	3	EE492	
ENE415	Power systems	3	ENE311	
MILS100	Military Science	3		
ME343	Automatic Control Systems	3	CE331	
ME3430	Automatic Control Systems Lab	1		ME343
NE 101	National Education	3		
	<b>Total</b>	<b>16</b>		

### VIII. Compulsory Courses Offered by EE Department

<b>EE241 Electronics I</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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.		
<i>Prerequisites:</i> ENE211		
<b>EE2410 Electronics I Lab</b>	<b>1 Cr Hr (0,3)</b>	<b>ECTS</b>
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.		
<i>Prerequisites:</i> ENE213, <i>Co-requisites</i> EE241		
<b>EE315 Probability, Statistics and Random Processes</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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.		
<i>Co-requisites:</i> MATH102		
<b>EE317 Linear Algebra</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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.		
<i>Prerequisites:</i> MATH102		
<b>EE321 Communication Systems I</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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.		
<i>Prerequisites:</i> CE331, <i>Co-requisite</i> EE315		
<b>EE3210 Communication Systems I Lab</b>	<b>1 Cr Hr (0,3)</b>	<b>ECTS</b>
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.		
<i>Co-requisites:</i> EE321		
<b>EE322 Communication Systems II</b>	<b>1 Cr Hr (3,0)</b>	<b>ECTS</b>
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.		
<i>Prerequisites:</i> EE321, <i>Co-requisite</i> EE315, EE317		

<b>EE3220 Communication Systems II Lab</b>	<b>1 Cr Hr (0,3)</b>	<b>ECTS</b>
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.		
<i>Co-requisites: EE322</i>		
<b>EE333 Electromagnetics</b>	<b>1 Cr Hr (3,0)</b>	<b>ECTS</b>
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.		
<i>Prerequisites: MATH203</i>		
<b>EE342 Electronics II</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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.		
<i>Prerequisites: EE241</i>		
<b>EE343 Digital Electronics</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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.		
<i>Co-requisites: EE241</i>		
<b>EE3430 Digital Electronics Lab</b>	<b>3 Cr Hr (0,3)</b>	<b>ECTS</b>
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.		
<i>Prerequisites: EE343</i>		
<b>EE361 Modeling and Simulation of Electrical Systems</b>	<b>1Cr Hr (0,3)</b>	<b>ECTS</b>
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.		
<i>Prerequisites: CE331</i>		
<b>EE371 IoT Architecture and Protocols</b>	<b>3Cr Hr (3,0)</b>	<b>ECTS</b>
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.		
<i>Prerequisites: CE352</i>		
<b>EE393 Field Training</b>	<b>0 Cr Hr (0,0)</b>	<b>ECTS</b>
Students must complete 160 hours of field training in approved industries in Jordan by the end of their third academic year.		
<i>Prerequisites: Department approval</i>		

<b>EE492: Senior Project I</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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.		
<i>Prerequisites:</i> Department approval		
<b>EE594: Senior Project II</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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.		
<i>Prerequisites:</i> EE492		
<b>EE493: International Internship</b>	<b>12 Cr Hr (12,0)</b>	<b>ECTS</b>
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.		
<i>Prerequisites:</i> Department Approval		
<b>EE510: Wireless and Mobile Communications</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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.		
<i>Prerequisites:</i> EE315		
<b>EE521: 5G</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
Evolution of wireless systems from 1G, 2G, 3G, 4G and 5G. Understand the basic knowledge of 5G core network. 5G development and evolution. 5G network architecture and key technologies. 5G new technology convergence and innovative applications. 5G basic service capabilities and applications. 5G industry applications, services, and marketing.		
<i>Prerequisites:</i> EE321		
<b>EE5210: 5G Lab</b>	<b>1 Cr Hr (3,0)</b>	<b>ECTS</b>
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.		
<i>Co-requisites:</i> EE521		
<b>EE541 Electronic Communication Circuits</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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.		
<i>Prerequisites</i> EE241, EE321		
<b>EE5410 Electronic Communication Circuits Lab</b>	<b>1 Cr Hr (0,3)</b>	<b>ECTS</b>
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.		
<i>Co-requisites:</i> EE541		

**EE570 Cloud Computing and Big Data****3Cr Hr (3,0)****ECTS**

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*

## IX. Elective Courses Offered by EE Department

<b>EE461 Digital Signal Processing</b>	<b>3 Cr Hr</b>	<b>ECTS</b>
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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:* EE493

<b>EE544 Sensors and Actuators</b>	<b>3 Cr Hr</b>	<b>ECTS</b>
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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:* EE493

<b>EE511 Satellite Communication Systems</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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:* EE493

<b>EE514: Multimedia Communications</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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:* EE493

<b>EE531 Antennas</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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.

*Prerequisites:* EE493

<b>EE532 RF and Microwave Engineering</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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.

*Prerequisites:* EE493

<b>EE551 Optical Fiber Communications</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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.

*Prerequisites:* EE493

**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.

*Prerequisites:* EE493

**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.

*Prerequisites:* EE493

**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.

*Prerequisites:* EE493

**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.

*Prerequisites:* EE493

**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:* EE493

**EE573 Special Topics in Smart Systems** **3 Cr Hr (3,0)** **ECTS**

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:* EE493

**EE574 Special Topics of Emerging Communication Systems** **3 Cr Hr (3,0)** **ECTS**

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:* EE493

<b>EE575 Special Topics in Radio Access Technologies</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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:* EE493

<b>EE576 Special Topics in Wireless Systems Energy Management</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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:* EE493

<b>EE577 Special Topics in Software Defined Networks</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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:* EE493

<b>EE578 Special Topics in Device-to-Device Communications</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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:* EE493

<b>EE580: Special Topics in IoT Management and Automation</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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:* EE493

<b>EE582: Special Topics in IoT Devices</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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:* EE493

<b>EE583: Special Topics in IoT Software Application Development</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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 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:* EE493

<b>EE584: Special Topics in IoT Electronics</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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:* EE493

<b>EE585: Special Topics in IoT Communications</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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: EE493

**EE586: Special Topics in IoT System Design** **3 Cr Hr (3,0)** **ECTS**

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: EE493

**EE587: Special Topics in IoT Enabling Technologies** **3 Cr Hr (3,0)** **ECTS**

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: EE493

**EE588: Special Topics in IoT Enabling Applications** **3 Cr Hr (3,0)** **ECTS**

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: EE493

**EE589: Special Topics in IoT Enabling Energy Management** **3 Cr Hr (3,0)** **ECTS**

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: EE493

**EE595: Special Topics in Electrical Engineering** **3 Cr Hr (3,0)** **ECTS**

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: EE493*

**EE596: Special Topics in Power Systems** **3 Cr Hr (3,0)** **ECTS**

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: EE493*

**EE597: Special Topics in Communication Engineering** **3 Cr Hr (3,0)** **ECTS**

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: EE493*

<b>EE598: Special Topics in Electronic Engineering</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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:* EE493

<b>EE599: Special Topics in Signal Processing</b>	<b>3 Cr Hr</b>	<b>ECTS</b>
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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:* EE493

### **X. Courses Offered by Other Departments**

<b>CE201: Computer Architecture and Organization</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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

<b>CE212: Digital Systems</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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

<b>CE2120: Digital Systems Lab</b>	<b>1 Cr Hr (0,3)</b>	<b>ECTS</b>
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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.

*Co-requisites:* CE212

<b>CE331: Signals and Systems</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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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

<b>CE352: Computer Networks</b>	<b>1 Cr Hr (3,0)</b>	<b>ECTS</b>
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.		
<i>Prerequisites:</i> CE201, CS116		
<b>CE3561: Computer Networks Lab</b>	<b>1 Cr Hr (0,3)</b>	<b>ECTS</b>
Gain hands on experience on computer network protocols and interfaces, OSI reference model, and Internet protocols.		
<i>Co-requisites:</i> CE352		
<b>CE441: Embedded System Design</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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.		
<i>Prerequisites:</i> CE201		
<b>CE342: Microprocessor and Microcomputer Systems</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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> EE493		
<b>CE354: Computer Security</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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> EE493		
<b>CE355: Data Communication</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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> EE493		
<b>CE444 Microcomputer Interface and Peripheral Devices</b>	<b>3 Cr Hr (3,0)</b>	<b>ECTS</b>
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.

*Prerequisites:* EE493

**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.

*Prerequisites:* EE493

**CE477: 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:* EE493

**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:* EE493

**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:* EE493

**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:* EE493

**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:* EE493

**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**

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.

*Co-requisites:* CS116

**CS214: Object Oriented Programming** **3 Cr Hr (3,0)** **ECTS**

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

**CS2140: Object Oriented Programming Lab** **1 Cr Hr (0,3)** **ECTS**

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.

*Co-requisites:* CS214

**CS330: Image Understanding** **3 Cr Hr (2,2)** **ECTS**

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:* EE493

**CS332: Computer Graphics** **3 Cr Hr (2,2)** **ECTS**

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:* EE493

**CS363: Database Management Systems** **3 Cr Hr (2,2)** **ECTS**

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:* EE493

**CS416: Systems Programming** **3 Cr Hr (2,2)** **ECTS**

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:* EE493

**CS460: Data Mining** **3 Cr Hr (3,0)** **ECTS**

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:* EE493

**CS461: Big Data** **3 Cr Hr (3,0)** **ECTS**

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:* EE493

**XI. Courses offered by Other Schools**

**ARB099: Arabic 99** **0 Cr Hr (3,0)** **0 ECTS**

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: -*

**ARB100: Arabic** **3 Cr Hr (3,0)** **3 ECTS**

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: ARB099*

**ENGL099: English II** **0 Cr Hr (3,0)** **0 ECTS**

Students will focus on English at a pre-intermediate level concentrating on the receptive skills of reading and listening and the productive skills of writing and speaking. These will include such things as comparatives and superlatives, quantifiers, possessive adjectives and pronouns, vocabulary building, role-play activities for speaking, reading comprehension and writing short descriptive paragraphs.

*Prerequisites: -*

**ENGL101: English III** **1 Cr Hr (3,0)** **3 ECTS**

Students will focus on English at an intermediate level concentrating on the receptive skills of reading and listening and the productive skills of writing and speaking. These will include collocations, tense review, affirmative, negative statements, synonyms and antonyms, time clauses, conditionals, active and passive forms, reported speech, phrasal verbs, reading comprehension with detailed questions, vocabulary and writing developed descriptive and opinion essays.

*Prerequisites: ENGL099*

**ENGL102: English IV** **1 Cr Hr (3,0)** **3 ECTS**

Students will focus on English at an upper-intermediate level concentrating on the receptive skills of reading and listening and the productive skills of writing and speaking. Model verb review, silent letters and proper pronunciation, jobs and careers, requests and offers, more phrasal verbs with vocabulary building, relative clauses and relative pronouns, narrative tenses for writing exercises, wishes and regrets, reading and comprehending longer passages with direct and inference questions of medium difficulty, hypothesizing, and writing fully developed descriptive, argumentative, and analytical essays of 350 words.

*Prerequisites: ENGL101*

**ENGL201: English V** **2 Cr Hr (3,0)** **3 ECTS**

Students will focus on English at an Advanced level. Students will analyze and produce 2 – 3 page 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.

*Prerequisites: ENGL102*

**ENGL202: English VI** **2 Cr Hr (3,0)** **3 ECTS**

Students will continue to focus on English at an Advanced level. Students will analyze and produce 4 – 5 page essays emphasizing argumentative, persuasive and discursive styles of writing, working both independently and cooperatively to gather, evaluate, and synthesize necessary information. Students will integrate the practice of critical thinking and reading into the writing process. Class activities include interactive lectures, small group and class discussions, informal debates, mini-conferences, 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 stronger and more intensive literary terms and concepts than in 201.

*Prerequisites:* ENGL201

<b>GERL101B1: German I B1 track</b>	<b>3 Cr Hr (9,0)</b>	<b>6 ECTS</b>
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By the end of this module, the student will be able to:

- Comprehend very familiar, everyday expressions and very simple sentences and structures related to areas of most immediate relevance according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the Level A1.1 (beginners without pre-knowledge).
- Introduce herself/himself and others, express likes and dislikes, fill out a personal form, ask questions and give answers in present and partially in past tense, set private and semi-official appointments, describe people and things and express frequency and quantity in a very basic way both orally and in writing.
- Communicate with native speakers on a very basic level if those involved in the conversation speak slowly and clearly and are willing to support the non-native speaker.

*Prerequisites:* Intensive pre-course (only for 1st semester of an academic year)

<b>GERL102B1: German II B1 track</b>	<b>3 Cr Hr (9,0)</b>	<b>6 ECTS</b>
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By the end of this module, the student will be able to:

- Understand and use familiar, everyday expressions and very simple sentences and structures related to areas of most immediate relevance according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level A1.2 (basic users).
- Introduce herself/himself and others, express likes and dislikes, fill out a personal form, ask questions and give answers in present and past tense, set private and official appointments, describe people and things, ask for directions, express frequency and quantity in a basic way both orally and in writing.
- Communicate with native speakers on a very basic level if those involved in the conversation speak slowly and clearly and, if need be, are willing to support the non-native speaker.

*Prerequisites:* GERL101B1

<b>GERL201B1: German III B1 track</b>	<b>3 Cr Hr (6,0)</b>	<b>4 ECTS</b>
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By the end of this module, the student will be able to:

- Understand and use familiar, frequently used expressions and simple sentences and structures related to areas of a wider immediate relevance according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level A2.1 (basic users).
- Talk about their academic and/or professional background, describe their living conditions, express likes and dislikes, ask questions and give answers in present and past tense, ask for help and support, make suggestions and give advice, describe health problems and talk with medical doctors and nurses, express pity, sorrow and hopes, express frequency and quantity in a basic way both orally and in writing.
- Communicate with native speakers within simple and familiar tasks requiring a simple and direct exchange of information on familiar and routine matters.

*Prerequisites:* GERL102B1

<b>GERL202B1: German IV B1 track</b>	<b>3 Cr Hr (9,0)</b>	<b>6 ECTS</b>
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By the end of this module, the student will be able to:

- Distinguish between familiar expressions, sentences and structures related to areas of immediate relevance and more elaborated components like the main points of clear standard input on familiar matters regularly encountered in work, school, leisure etc. according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level A2.2 (basic users) and, partially, at the level B1.1 (independent user).
- Talk about personal experiences with languages, express feelings of happiness, joy and discomfort, describe own media consumption habits, describe travel experiences, convince others, describe and

report in official situations, describe statistics, write formal invitations and short emails, make suggestions and talk about future events and situations, describe dreams hopes and ambitions and briefly give reasons or explanations for opinions and plans.

- Communicate with native speakers about essential points and ideas in familiar contexts.
- Understand the characteristics of the official B1 exam according to the CEFR and use strategies to overcome obstacles while solving said exam.

*Prerequisites:* GERL201B1

<b>GERL301B1: German V B1 track</b>	<b>3 Cr Hr (9,0)</b>	<b>6 ECTS</b>
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By the end of this module, the student will be able to:

- Understand the main points of clear standard input on familiar matters regularly encountered in work, school, leisure etc. according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level B1.1 and B1.2 (independent user).
- Deal with most situations likely to arise whilst traveling in an area where German is spoken, produce simple connected texts on topic which are familiar or of personal interest, describe experiences and events, dreams, hopes and ambitions, statistics, and briefly give reasons and explanations for opinions and plans.
- Understand the main point of many radio or TV programmes on current events and topics, understand the description of events, feelings and wishes in personal letters, write personal letters/texts describing experiences and impressions, write straightforward connected texts on topics which are familiar or of personal interest.
- Communicate with native speakers about essential points and ideas in familiar contexts and about topics of personal or partially professional interest.
- Follow a lecture or talk within her/his field, provided the subject matter is familiar and the presentation straightforward and clearly structured.
- Understand simple technical information, such as operating instructions for everyday equipment.
- Understand all characteristics of the official B1 exam according to the CEFR and use a variety of strategies to overcome obstacles while solving said exam and all its components.

*Prerequisites:* GERL202B1

<b>GERL302REG: German VI Regular</b>	<b>3 Cr Hr (6,0)</b>	<b>6 ECTS</b>
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By the end of this module, the student will be able to:

- Successfully manage the application process for a six months internship in Germany which is part of the obligatory 'German Year' for all GJU students. The process consists of finding and understanding a suitable add in accordance with the students' major, writing a convincing CV and cover letter, and mastering an effective and mostly fluent interview, departing spontaneously, taking initiatives, expanding ideas with little help, or prodding from the interviewer.
- Successfully manage the most significant situations which the student, in accordance with the currently studied major, encounters during her/his theoretical and practical semester in Germany. This process is being achieved within a technical language training focussing on action orientated and communicative scenarios like following lectures, taking notes, summarizing academic and technical texts, writing official emails and texts related to academic and vocational encounters, holding presentations, communicating both verbally and in writing with professors, university staff, students as well as with colleagues and customers during an internship.
- Understand the concept of general intercultural phenomena, reflect and understand the differences between culture and cultural standards in Jordan and in Germany, understand the concept of 'culture shock' and potentially cope with its different stages, reflect about appropriate and inappropriate behaviour in Germany as well as understand the concepts of open-mindedness and 'culture clash'.

*Prerequisites:* GERL301B1

<b>GERL302INT: German VI Intensive</b>	<b>3 Cr Hr (9,0)</b>	<b>6 ECTS</b>
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By the end of this module, the student will be able to:

- Successfully manage the application process for a six months internship in Germany which is part of the obligatory 'German Year' for all GJU students. The process consists of finding and understanding a suitable add in accordance with the students' major, writing a convincing CV and cover letter, and mastering an effective and mostly fluent interview, departing spontaneously, taking initiatives, expanding ideas with little help, or prodding from the interviewer.
- Successfully manage the most significant situations which the student, in accordance with the currently studied major, encounters during her/his theoretical and practical semester in Germany. This process is being achieved within a technical language training focusing on action orientated and communicative scenarios like following lectures, taking notes, summarizing academic and technical texts, writing official emails and texts related to academic and vocational encounters, holding presentations, communicating both verbally and in writing with professors, university staff, students as well as with colleagues and customers during an internship.
- Understand the concept of general intercultural phenomena, reflect and understand the differences between culture and cultural standards in Jordan and in Germany, understand the concept of 'culture shock' and potentially cope with its different stages, reflect about appropriate and inappropriate behavior in Germany as well as understand the concepts of open-mindedness and 'culture clash'.
- Understand all characteristics of the official B1 exam according to the CEFR and use different strategies to overcome obstacles while solving said exam and its different components.

*Prerequisites:*

**GERL102B2: German II B2 track**

**3 Cr Hr (9,0)**

**6 ECTS**

By the end of this module, the student will be able to:

- Understand and use familiar, everyday expressions and simple sentences and structures related to areas of most immediate relevance according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level A1.2 and, partially, A2.1 (basic users).
- Talk about their academic and/or professional background, describe their living conditions, express likes and dislikes, ask questions and give answers in present and past tense, ask for help and support, make suggestions and give advice, express pity, sorrow and hopes, express frequency and quantity in a basic way both orally and in writing.
- Introduce herself/himself and others, express likes and dislikes, fill out a personal form, ask questions and give answers in present and past tense, set private and official appointments, describe people and things, ask for directions, express frequency and quantity in a basic way both orally and in writing.
- Communicate with native speakers on a basic level if those involved in the conversation speak slowly and clearly and, if need be, are willing to support the non-native speaker.

*Prerequisites:* GERL101B1

**GERL201B2: German III B2 track**

**3 Cr Hr (6,0)**

**4 ECTS**

By the end of this module, the student will be able to:

- Distinguish between familiar expressions, sentences and structures related to areas of immediate relevance and more elaborated components like the main points of clear standard input on familiar matters regularly encountered in work, school, leisure etc. according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level A2.1 and A2.2 (basic users).
- Talk about their academic and/or professional background, describe their living conditions, express likes and dislikes, ask questions and give answers in present and past tense, ask for help and support, make suggestions and give advice, describe health problems and talk with medical doctors and nurses, express pity, sorrow and hopes, describe simple statistics, express frequency and quantity in a basic way both orally and in writing, express feelings of happiness, joy and discomfort and write personal emails and letters, understand and produce comments, blogs and reports.

- Communicate with native speakers in simple and familiar tasks requiring a simple and direct exchange of essential information on familiar and routine matters.

*Prerequisites:* GERL102B2

<b>GERL202B2: German IV B2 track</b>	<b>3 Cr Hr (9,0)</b>	<b>6 ECTS</b>
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By the end of this module, the student will be able to:

- Understand the main points of clear standard input on familiar matters regularly encountered in work, school, leisure etc. according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level B1.1 and B1.2 (independent user).
- Deal with most situations likely to arise whilst traveling in an area where German is spoken, produce simple connected texts on topic which are familiar or of personal interest, describe experiences and events, dreams, hopes and ambitions and briefly give reasons and explanations for opinions and plans.
- Understand the main point of many radio or TV programmes on current events and topics, understand the description of events, feelings and wishes in personal letters, write personal letters/texts describing experiences and impressions, write straightforward connected texts on topics which are familiar or of personal interest.
- Communicate with native speakers about essential points and ideas in familiar contexts and about topics of personal or partially professional interest.
- Follow a lecture or talk within her/his field, provided the subject matter is familiar and the presentation straightforward and clearly structured.
- Understand simple technical information, such as operating instructions for everyday equipment.
- Understand all characteristics of the official B1 exam according to the CEFR and use different strategies to overcome obstacles while solving said exam and all its components.

*Prerequisites:* GERL201B2

<b>GERL301B2: German V B2 track</b>	<b>3 Cr Hr (9,0)</b>	<b>6 ECTS</b>
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By the end of this module, the student will be able to:

- Largely understand and produce rather complex texts on both concrete and abstract topics, including technical discussions in her/his field of specialisation and according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level B2.1 (independent user).
- Interact with an initial degree of fluency and spontaneity that makes regular interaction with native speakers quite possible without strain for either party.
- Largely understand standard spoken language, live or broadcast, on both familiar and unfamiliar topics normally encountered in personal, social, academic or vocational life.
- Show a relatively high controlled degree of grammatical control without making errors which cause misunderstanding and with the growing ability to correct most of her/his mistakes.
- Largely follow essentials of lectures, talks, reports, and other forms of academic/professional presentation which are propositionally and linguistically complex.
- Understand announcements and messages on concrete and abstract topics spoken in standard dialect at normal speed.
- Scan quickly through long texts, locating relevant details and understand and exchange complex information and advice on the full range of matters related to her/his occupational role.
- Understand the main characteristics of the official B2 exam according to the CEFR and use different strategies to overcome obstacles while solving said exam and its different components.

*Prerequisites:* GERL202B2

<b>GERL302B2: German VI B2 track</b>	<b>3 Cr Hr (6,0)</b>	<b>6 ECTS</b>
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By the end of this module, the student will be able to:

- Understand and produce rather complex texts on both concrete and abstract topics, including technical discussions in her/his field of specialisation and according to the discretionary standards in the *Common European Framework of Reference for Languages* (CEFR) at the level B2.2 (independent user).

- Interact with a degree of fluency and spontaneity that makes regular interaction with native speakers quite possible without strain for either party.
- Understand standard spoken language, live or broadcast, on both familiar and unfamiliar topics normally encountered in personal, social, academic or vocational life.
- Show a highly controlled degree of grammatical control without making errors which cause misunderstanding and with the growing ability to correct most of her/his mistakes.
- Follow essentials of lectures, talks, reports and other forms of academic/professional presentation which are propositionally and linguistically complex.
- Understand announcements and messages on concrete and abstract topics spoken in standard dialect at normal speed.
- Scan quickly through long texts, locating relevant details and understand and exchange complex information and advice on the full range of matters related to her/his occupational role.
- Understand all characteristics of the official B2 exam according to the CEFR and use different strategies to overcome obstacles while solving said exam and its different components.
- Successfully manage the application process for a six months internship in Germany which is part of the obligatory 'German Year' for all GJU students. The process consists of finding and understanding a suitable add in accordance with the students' major, writing a convincing CV and cover letter, and mastering an effective and mostly fluent interview, departing spontaneously, taking initiatives, expanding ideas with little help, or prodding from the interviewer.
- Successfully manage the most significant situations which the student, in accordance with the currently studied major, encounters during her/his theoretical and practical semester in Germany. This process is being achieved within a technical language training focussing on action orientated and communicative scenarios like following lectures, taking notes, summarizing academic and technical texts, writing official emails and texts related to academic and vocational encounters, holding presentations, communicating both verbally and in writing with professors, university staff, students as well as with colleagues and customers during an internship.
- Understand the concept of general intercultural phenomena, reflect and understand the differences between culture and cultural standards in Jordan and in Germany, understand the concept of 'culture shock' and potentially cope with its different stages, reflect about appropriate and inappropriate behaviour in Germany as well as understand the concepts of open-mindedness and 'culture clash'.

*Prerequisites:* GERL301B2

<b>BE302: Business Entrepreneurship</b>	<b>3 Cr Hr (3,0)</b>	<b>3 ECTS</b>
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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:* English101

<b>DES101: Arts Appreciation</b>	<b>3 Cr Hr (3,0)</b>	<b>3 ECTS</b>
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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:* ARB099, ENGL101

<b>EI101: Leadership and Emotional Intelligence</b>	<b>3 Cr Hr (3,0)</b>	<b>3 ECTS</b>
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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:* ENGL101

**IC101: Intercultural Communication** **3 Cr Hr (3,0)** **3 ECTS**

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:* English101

**MILS100: Military Science** **3 Cr Hr (3,0)** **3 ECTS**

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**

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**

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:* ARB099

**SE301: Social Entrepreneurship and Enterprises** **3 Cr Hr (3,0)** **3 ECTS**

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:* English101

**SFTS101: Soft Skills** **3 Cr Hr (3,0)** **3 ECTS**

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 emphasizes 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:* English101

**TW303: Technical and Workplace Writing** **3 Cr Hr (3,0)** **3 ECTS**

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:* English102

**ENE211: Electrical Circuits I** **3 Cr Hr (3,0)** **ECTS**

SI units, voltage and current; Ohm's and Kirchhoff's Laws, circuits with dependent sources; simple resistive circuits: series, parallel and delta to wye; techniques of circuit analysis: nodal and mesh analyses, source transformation, Thevenin and Norton equivalents; amplifiers; inductance, capacitance and mutual inductance; natural and step responses of RL and RC circuits; natural and step response of series and parallel RLC circuits; sinusoidal steady state analysis.

*Prerequisites:* PHYS104

**ENE212: Electrical Circuits II** **3 Cr Hr (3,0)** **ECTS**

Average, reactive and complex power, power measurements; polyphase circuits, mutual inductances; Laplace Transforms, frequency response, impulse and step response, passive and active filters, Fourier series and the Fourier Transform, two-port circuits.

*Prerequisites:* ENE211

**ENE213: Electrical Circuits Lab** **1 Cr Hr (0,3)** **ECTS**

Resistive circuits, potentiometers, superposition, Thevenin theorem, maximum power transfer, RLC current and voltage characteristics, frequency response of RL and RC circuits, series and parallel resonant circuits.

*Prerequisites:* ENE211

**ENE311: Electrical Machines** **3 Cr Hr (3,0)** **ECTS**

transformers: performance characteristics, three-phase connections, autotransformers; DC machines: performance equations, generator and motor characteristics, starting and speed control of motors; single phase induction motors; three-phase induction motors: operation, performance calculations, starting and speed control; synchronous machines: generator and motor operation; small synchronous motors; universal motors;

*Prerequisites:* ENE212, EE333

**ENE313: Electrical Machines Lab** **1 Cr Hr (0,3)** **ECTS**

transformers, three-phase transformer methods of connection, DC motors, DC generators, three-phase induction motors, single-phase induction motors, three-phase synchronous generator and motor, AC series motor, lab project.

*Prerequisites:* ENE311

**ENE415: Power Systems** **3 Cr Hr (3,0)** **ECTS**  
Introduction to power systems, transformers, series impedance of transmission lines, capacitance of transmission lines, current and voltage relations on a transmission line, impedance and admittance models and network calculations, Gauss-Seidel and Newton-Raphson methods to solve nonlinear algebraic equations, power flow, symmetrical faults.

*Prerequisites:* ENE311

**ENE433: Solar Energy I** **3 Cr Hr (3,0)** **ECTS**  
Heat transfer phenomena (radiation, convection, conduction) in solar thermal systems; materials used in solar thermal applications and their properties: selective treatments, phase change materials, transparent insulating surfaces; design methodologies and calculation of solar thermal systems and equipment; heat transfer calculation software; testing of solar thermal collectors and solar thermal systems; applications of solar energy: absorption cooling systems, solar thermal energy system as a primary source of electricity; solar thermal concentration (solar thermo-electric).

*Prerequisites:* EE493

**ENE516: Smart-Grids** **3 Cr Hr (3,0)** **ECTS**  
This course presents a new concept in power systems, by integrating Power systems with Power electronics, Communications and information technology. In addition, the concept of involving intelligent control using SCADA system will be presented.

*Prerequisites:* EE493

**ENE517: Power Systems Protection** **3 Cr Hr (3,0)** **ECTS**  
power system protection, fault analysis, instrument transformers, overcurrent protection, distance protection, differential protection, pilot protection, generator protection, motor protection, transmission line protection, transformer protection, bus protection, radial reactor and shunt capacitor protection.

*Prerequisites:* EE493

**ENE518: High Voltage Engineering** **3 Cr Hr (3,0)** **ECTS**  
Generation and measurement of high voltage, electrostatic field and field stress control, electrical breakdown in gases, solids and liquids, non-destructive insulation test techniques, over-voltages and insulation coordination

*Prerequisites:* EE493

**ENE530: Advanced Renewable Energy Systems** **3 Cr Hr (3,0)** **ECTS**  
analysis of alternative and renewable energy systems; methods of integrating these solutions with society; sustainable energy; principles, possibilities, and limits of alternative and renewable energy.

*Prerequisites:* EE493

**ENE537: Energy Efficiency, Management and Laws** **3 Cr Hr (3,0)** **ECTS**  
Technical and physical processes involved in energy usage in: residential, commercial, industrial and transport sectors; economic tools required to justify expenditure on energy efficiency programs; “whole system” design and analysis; policy and environmental requirements to enhance implementation of energy efficiency measures;

*Prerequisites:* EE493

**ENE547: Power System Stability** **3 Cr Hr (3,0)** **ECTS**  
Power system stability concepts, the classical machine model, modeling of synchronous machines, modeling of loads, excitation system types, dynamic models of excitation system, response of a power network to disturbances, small signal stability, voltage stability.

*Prerequisites:* EE493

**MATH099: Pre-Math** **0 Cr Hr (3,0)** **0 ECTS**

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.

*Prerequisites:*

**MATH101: Calculus I** **3 Cr Hr (3,0)** **3 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:* MATH099

**MATH102: Calculus II** **3 Cr Hr (3,0)** **3 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

**PHYS103 Physics I** **3 Cr Hr (3,0)** **3 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)** **3 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)** **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:* PHYS104

**CHEM103: General Chemistry** **3 Cr Hr (3,0)** **3 ECTS**

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)** **3 ECTS**

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

**IE121: Engineering Workshops**

**1 Cr Hr (0,3)**

**3 ECTS**

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:*

**ME343 Automatic Control Systems**

**4 Cr Hr (3,3)**

**ECTS**

Modeling of electrical, pneumatic, hydraulic, and mechanical systems, Transfer functions, block diagrams, and signal flow graph. Time domain analysis, test signals, transient response, steady state error and stability. Root locus, bode plots, PID control, phase-lead, phase lag. Software application such as Matlab and Simulink.

*Prerequisites:* MATH203