جامعة الحسين التقنية
Al Hussein Technical University

School of Engineering Technology

Energy Engineering Department

Bachelor's Degree in Energy Engineering

Study Plan

2022

Program Objectives

1. Provide world-class, flexible, STEM-based education which combines in-depth technical knowledge with professional, leadership, and entrepreneurial skills.
2. Build advanced practical and technical skills to enable the student to conceive, design, build, and test complex engineering systems.
3. Provide the student with a hands-on understanding of the evolving market needs through a tailored and intensive industry-based apprenticeship scheme.
4. Create opportunities to enhance the student's character, soft skills, and adaptation abilities within different multidisciplinary teams and changing professional environments.
5. Emphasize the need for engaging in life-long and independent learning and professional development.
6. Equip the student with the up-to-date and relevant preparation for employment in a variety of technical and engineering fields, or for initiating an innovative entrepreneurial venture or a technology startup.
7. Enable the student to progress in graduate studies in relevant technical or engineering fields.

Learning Outcomes

Upon graduation, the graduate of the Energy Engineering Program should be able to:

1. Apply knowledge of science, mathematics, technology, and engineering fundamentals to energy engineering applications.
2. Design and conduct experiments, as well as analyze and present results in a professional manner.
3. Design, model, analyze and build practical energy systems to meet specific requirements and realistic constraints.
4. Use the techniques, skills, and modern engineering and computing tools necessary for engineering practice.
5. Identify, formulate, and solve engineering problems.
6. Communicate effectively, and function in multidisciplinary teams.
7. Understand professional and ethical issues and the responsibilities of the engineering practice.
8. Recognize contemporary issues and environmental, cultural, and economical consideration of the engineering profession.
9. Appreciate the need for professional development and engage in life-long learning.
10. Engage in entrepreneurial activity and understand the value of technology innovation.
11. Understand the requirements and constraints of the professional employment environment.

Assessment of Learning Outcomes

Assessment model requires the students to engage with a variety of assessment tools that are accessible, appropriately challenging, and support the development of student self-efficacy and self-confidence. To ensure that assignments are valid and reliable, a robust quality assurance system that measures and monitor the effectiveness of their implementation is adopted. This includes ensuring that all students engage in assessment positively and honestly. Assessment also provides a learning opportunity for all stakeholders of the assessment to have access to feedback that is both individual to each student and holistic to the cohort. Feedback to students should be supportive and constructive. Student self-efficacy (and therefore self-confidence) can be significantly enhanced where feedback not only focuses on areas for improvement, but recognizes the strengths a student has. At the cohort level, similar trends could be identified that could inform future approaches to assessments and teaching.

Framework for bachelor's Degree

Classification	Credit Hours		
	Compulsory	**Elective**	**Total**
University Requirements	24	3	27
School Requirements	35	0	35
Program Requirements	77	9	86
Professional Apprenticeship Training	18	0	18
Total	**154**	**12**	**166**

1. University Requirements: (27 credit hours)

1.1. Compulsory: (24 credit hours)

Course ID	Course Title	Credit Hours	Contact Hours		Prerequisite
			Lecture	Practical	
30301121	Pre-Intermediate English Intensive + Lab	4	3	6	30301120 Pre-Foundation English Elementary Intensive
30301122	English Intermediate	3	6	0	30301121
30301123	English Upper-Intermediate	3	6	0	30301122
30301124	English Advanced	3	6	0	30301123
40302111	Professional Skills	1	2	0	-
40302112	Professional Practice	3	4	0	40302111
40302231	Entrepreneurship Boot camp	4	2	6	30301123 &40302211
30302232	Leadership Camp*	1	3	0	30302231 &40302231
30302129	Military Science	1	1	0	-
30301111	Arabic Language and communication skills	1	1	0	Arabic Placement test score ≥60 or 30301110
	Total	**24**			

1.2. Elective: 3 Credit Hours (Three courses out of the following)

Course ID	Course Title	Credit Hours	Contact Hours		Prerequisite
			Lecture	Practical	
30301130	Foundational French Language	1	3	0	-
30301131	French language Level 1	1	3	0	30301130
30301132	French Language Level 2	1	3	0	30301131
30301133	French Language Level 3	1	3	0	30301132
30301140	Foundational German Language	1	3	0	-
30301141	German Language level 1	1	3	0	30301140
30301160	Foundational Turkish Language	1	3	0	-
30301170	Foundational Italian Language	1	3	0	-
30301171	Italian language	1	3	0	-
30301180	Chinese 1	1	3	0	-
30301221	Development Academic Writing	1	3	0	30301124
30301222	Research and Technical Writing	1	3	0	30301124
30302121	Science & Society Seminar I: Arab Contributions to Science and Arts	1	3	0	-
30302122	Science & Society Seminar II: Philosophy of Science	1	3	0	-

30302123	Art Appreciation and Techniques	1	3	0	-
30302124	Civil & Professional Culture	1	3	0	-
30302125	Rights and Responsibilities: Understanding Human Rights	1	3	0	
30302126	Introduction to culture Anthropology -Focus on Urban Anthropology	1	3	0	
30302127	Jerusalem, History and Civilization	1	3	0	
30302128	Jordan: History and Civilization	1	3	0	
30302133	Principles of Management	1	3	0	
30302134	Strategies for Industry Competitiveness: Tools & Techniques	1	3	0	
30302135	Principles of Accounting	1	3	0	
30302136	Principles of Economics	1	3	0	
30302237	Free choice Elective	1	3	0	
40302233	Business Analytics	1	3	0	
40302221	Speech and Debate	1	3	0	
30301223	Introduction to Translation	1	3	0	30301124
	Total	**3**			

2. School Requirements: (35 credit hours)

Course ID	Course Title	Credit Hours	Contact Hours		Type	Prerequisite
			Lecture	Practical		
30303111	Functional Math	3	3	0	HTU	3030110
30303112	Functional Physics	3	3	0	HTU	-
40303130	Fundamentals of Computing	4	6	0	HTU	-
00101100	Introduction to Engineering Drawing	1	0	3	HTU	-
00103101	STEM Lab I	1	0	3	HTU	-
00102102	STEM Lab II	1	0	3	HTU	00103101
00101103	Workshop I	2	0	6	HTU	-
00101104	Workshop II	1	0	3	HTU	00101103
00103110	Engineering Math	4	3	3	HNC	30303111
00102111	Engineering Science	4	3	3	HNC	30303112
00101112	Engineering Design	4	3	3	HNC	00101100
00102220	Managing a Professional Engineering Project	4	3	3	HNC	00101112
00103375	Introduction to AI and Data Sciences	3	2	3	HTU	40303130 & 00103110
	Total	**35**				

3. Program Requirements (89 credit hours)

3.1. Compulsory: (77 credit hours)

Course ID	Course Title	Credit Hours	Contact Hours		Type	Prerequisite
			Lecture	Practical		
00102205	Advanced Workshop for Energy Engineers	1	0	3	HTU	00101104
00101240	Fundamentals of Thermodynamics and Heat Engines	4	3	3	HNC	00102111
00101241	Fluid Mechanics	4	3	3	HNC	00102111
00103230	Electrical and Electronic Principles	4	3	3	HNC	00102111
00103240	Electronic Circuits and Devices	4	3	3	HNC	00103230
00101442	Heat and Mass Transfer	3	2	3	HTU	00101240
00103250	Instrumentation and Control Systems	4	3	3	HNC	00103230
00103213	Further Mathematics	4	3	3	HND	00103110
00102321	Professional Engineering Management	4	3	3	HND	00102220
00101366	Lean Manufacturing	4	3	3	HND	00101112
00101343	Further Thermodynamics	4	3	3	HND	00101240
00103331	Industrial Power, Electronics and Storage	4	3	3	HND	00103240
00103232	Further Electrical, Electronic and Digital Principles	4	3	3	HND	00103230, 00103213
00102490	Research Project for Energy Engineers	4	4	0	HND	Department Approval
00102330	Energy Resources and Conversion	3	3	0	HTU	00101240
00102340	Renewable Energy Systems and Technologies	3	2	3	HTU	00102111
00103534	Power Systems	3	3	0	HTU	00103232
00102532	Energy Efficiency and Management	3	2	3	HTU	00102330
00101345	Heating, Ventilation and Air Conditioning (HVAC)	3	2	3	HTU	00101240
00102531	Energy Economics, Policy, and Regulations	3	3	0	HTU	00102330
00102541	Photovoltaic Systems	3	2	3	HTU	00103232 & 00102340
00102523	Health, safety, and Environment	1	1	0	HTU	00102321
00102594	Capstone Project for Energy Engineers	1	0	3	HTU	00102490
00102595	Capstone Project for Energy Engineers continuation	2	0	6	HTU	00102594
	Total	**77**				

3.2. Electives: (9 credit hours) (Three courses out of the following)

A minimum of 12 credit hours of engineering coursework are required. This list is considered open for modifications on the base of the decision of the school council before registration.

Course ID	Course Title	Credit Hours	Contact Hours		Type	Prerequisite
			Lecture	Practical		
00102522	Maintenance Engineering	3	3	0	HTU	00102321
00102542	Solar Thermal Systems	3	2	3	HTU	00101242
00102543	Wind Energy	3	2	3	HTU	00103333
00102544	Green Buildings	3	2	3	HTU	00102111
00102545	Sustainability	3	3	0	HTU	00102340
00102550	Energy Storage	3	2	3	HTU	00103331
00102551	Smart Grids	3	2	3	HTU	00103331, 00103534
00102552	Electric and Hybrid Vehicles	3	2	3	HTU	00103333
00102553	Energy Simulation in buildings	3	2	3	HTU	00101545
00102593	Special Topics in Energy Engineering	3	3	0	HTU	Department Approval
00103333	Electrical Machines	3	2	3	HTU	00103232
	Total	**9**				

4. Professional Apprentice Requirements (18 credit hours) (8 months)

Course ID	Course Title	Credit Hours	Contact Hours		Type	Prerequisite
			Lecture	Practical		
00102496	Practical Training for Energy Engineers (PATH)	6	0	10	HTU	30302231 & 30301123
00102497	Practical Training for Energy Engineers (PATH) continuation	12	0	30	HTU	00102496
	Total	**18**				

University Compulsory Course Descriptions

30301120: Pre-Foundation English Elementary Intensive + Lab. 4 Cr (6,3)

This foundation course deals with all language skills: speaking, listening, reading, writing, grammar review, and vocabulary building. The overall objective of the course is to ensure that students will be able to understand straightforward information in the spoken and written language and to express themselves in speech and in writing for simple practical purposes in everyday situations requiring a simple and direct exchange of information.

By the end of the course, students will reach an A2 level on the Global Scale of English (GSE). Students will be evaluated on their ability to understand sentences and frequently used expressions related to areas of most immediate relevance. Students will be able to describe in simple terms aspects of their background, immediate environment, and matters in areas of immediate need.

This course also includes a scheduled lab time, dedicated to practice and/or other work assigned by the instructor to enhance students' communication skills [including assigned homework/in-class practice], writing or speaking workshops, and projects.

Prerequisites: Placement test score: Pearson 0-35, VTEST A1, A2.1, A2.2 (0-34) TOEFL IBT: 0-31, IELTS: 0-4.0, TOEFL ITP: 0-399

30301121 : Pre-Intermediate English Intensive + Lab 4 Cr (6,3)

This foundation course deals with all language skills: speaking, listening, reading, writing, grammar review, and vocabulary development. The overall objective of the course is to ensure that students could understand and express in speech and writing: information, ideas, feelings, opinions, and common functions about situations relating to English skills.

By the end of the course, students will reach a B1 level on the Global Scale of English (GSE). Students will be evaluated on their ability to understand the main points of clear standard input on familiar matters regularly B encountered in the typical work-related environment/setting, specifically in relation to technical-English related communication skills. In addition, students are required to be able to deal with most situations likely to arise while at the work-place or in the field where English is spoken; in addition to the type of setting they would need to communicate to other stakeholders (customer/ client, supervisor, sponsor/funding entity/ supplier and so on). Students will be able to produce simple connected text on topics which are familiar in their field of study, and in relation to basic communication skills needed. Finally, students will be able to describe experiences and work-related skills, their opinion, plans, and other practical, relevant communication skills.

This course also includes a scheduled lab time, dedicated to practice and/or other work assigned by the instructor to enhance students' communication skills [including assigned homework/in-class practice], writing or speaking workshops, and projects pertaining.

Prerequisites: Placement test score: Pearson 36-46, VTEST B1.1 (35-45) TOEFL IBT: 32-42 (Minimum score of 6 in each of the four sections) IELTS: 4.5 (Minimum score of 4.0 in each of the four sections) TOEFL ITP: 400-442 or 30301120

30301122: English Intermediate **3 Cr (6,0)**

This course is meant to follow on from 30301121; it is for students who have completed level 2 and now require an intermediate course in Technical English, and it is benchmarked against CEFR level B1+. This course targets students in technical or vocational education who want to develop their careers and technical skills, as it aims to prepare them for the successful and effective use of English in their studies and occupations. The course adopts a practical task-based approach, consisting of work-specific communicative functions, technology-specific notions or concepts, grammar, vocabulary, and skills. The syllabus is designed to reflect current and future developments in technology, whereby everything is selected based on high frequency of use and relevancy of needs across a range of technical contexts, including technical training and work contexts.

Prerequisites: Placement test score: Pearson 47-58, VTEST B1.2 (46-55), TOEFL IBT: 43-52 (Minimum score of 10 in each of the four sections), IELTS: 5.0 (Minimum score of 4.5 in each of the four sections), TOEFL ITP: 443-476, or 30301121

30301123: English Upper-Intermediate **3 Cr (6,0)**

This course is for students in technical or vocational education, and for company employees in training at work. It covers the core language and skills that students need to communicate successfully in all technical and industrial specializations. It is for students who have an intermediate level of general English and now require an upper intermediate course in English for specific purposes. This is benchmarked against CEF level B2.
The course uses a multi-thread syllabus consisting mainly of communicative functions, notions, grammar, vocabulary, and skills. The work-specific communicative functions (e.g., giving instructions, making recommendations') and technology-specific notions or concepts (e.g., causation, resistance) are selected on the basis of relevance to the needs of students in technical training and work contexts. Grammatical exponents of functions and notions are selected based on frequency and relevance to needs. In this level, the syllabus organization is increasingly driven by topics, skills and genre or text type, within which appropriate grammar, vocabulary, functions, and notions are introduced or recycled. The vocabulary of the course is a selection of common core lexical items that have a high frequency of use across a range of technical and industrial contexts. Many of these items can be found in general contexts but have a greater frequency and often a more specific meaning in technical contexts. Many of them are the kind of words which a specialist in one field might use to explain technical concepts and specialized terms to the public, or to specialists in other fields.

Prerequisites: Placement test score: Pearson 59-68, VTEST: B2.1 (56-68), TOEFL IBT: 53-78 (Minimum score of 14 in each of the four sections), IELTS: 5.5-6.0 (Minimum score of 5.0 in each of the four sections) , TOEFL ITP: 477-547 or 30301122

30301124: English Advanced **3 Cr (6,0)**

This course is meant to follow 30301123. This course deals with all language skills: speaking, listening, reading, writing, grammar review, and vocabulary building. The overall objective of the course is to ensure that students

can understand and respond appropriately in the spoken and written form to a wide range of demanding, longer texts and recognize implicit meaning.
By the end of the course, students will reach a C1 level on the Global Scale of English (GSE). Students will be evaluated on their ability to express themselves fluently and spontaneously without much obvious searching for expressions. In addition, students are required to be able to use language flexibly and effectively for social, academic, and professional purposes. Students will be able to produce clear, well-structured, detailed text on complex subjects, showing controlled use of organizational patterns, connectors, and cohesive devices. (Exempted if Placement test score: Pearson ≥ 81, VTEST ≥ C1 (≥81), TOEFL IBT: ≥ 102 (Minimum score of 22 in each of the four sections), IELTS: ≥ 7.5 (Minimum score of 6.5 in each of the four sections), TOEFL ITP: ≥ 608).

Placement test score: Pearson 69-80, VTEST B2.2 (69-80) IELTS: 6.5-7.0 (Minimum score of 6.0 in each of the four sections), TOEFL ITP: 548-607, or 30301123

40302111: Professional skills **1 Cr (3,0)**

This course introduces students to the basic personal and interdependent competencies necessary to have a successful career and lead a fulfilling life. The course focuses on developing students' self-awareness, self-esteem, and confidence, as they relate to goal development, values, interests, and skills. The course gives special attention to interpersonal and communication skills including listening, speaking, and writing. In addition, the course introduces students to effective time management and organization skills, the dynamics of working within a team, and how attitude affects interpersonal relationships. The course serves as a prerequisite for a later course titled Soft Skills II that focuses on professional practice and career readiness.

Prerequisites: -

40302112: Professional Practice **3 Cr (3,0)**

This course aims to cover the general aspects of employability skills and to provide students with the tools and resources needed to make informed career decisions. The course put special emphasis on skills that can be transferable among a variety of professions and careers and are considered essential in any employment setting. Students will learn to assess and identify the skills required to increase their chances of finding a job and perform better in the workplace. The course covers personal and interpersonal skills, written communication, teamwork, and leadership development. The course introduces students to critical thinking and problem-solving techniques in addition to personal and professional development planning.

Prerequisites: 40302111&30301122

30302129: Military Science **1 Cr (3,0)**

The Military Science course is one of many components of the National Strategy for Higher Education in Jordan and is thus an extension of the Ministry of Education's philosophy for Higher Education. The course

covers the concept of a comprehensive national security strategy, both its traditional and social definitions, with the aim of consolidating the values of loyalty and belonging to the nation, which includes the land and its people, the system of governance, and the national security systems and military institutions; the course thus prepares students to fulfil their roles in society as self-aware and responsible citizens who hold the power to advance positive change and maintain a safe and stable nation. Furthermore, the course aims to enrich students' knowledge about the history of the Hashemite Kingdom of Jordan and its development, and to provide essential information about the Jordanian armed forces and security systems, highlighting their crucial role in protecting our nation's greater interests, and in serving and supporting the development of the local, Arab, and global communities. Moreover, the course aims to increase students' awareness of the concept of national security through a comprehensive study of critical issues, including psychological warfare and the dangers of drugs and terrorism. Ultimately, the course aims to highlight the benefits of holding on to our treasured Jordanian values of loyalty, belonging, citizenship, and the importance of utilizing our national resources.

Prerequisites: -

40302231: Entrepreneurship Bootcamp **4 Cr (4,0)**

HTU's Accelerated Innovation and Entrepreneurship Bootcamp is an experiential learning journey that all HTU students undergo as part of their degree program at HTU. Students are formed into high-performing teams with the mission to develop a desirable, feasible and viable solution that targets a specific customer segment with an attractive market size, while addressing one or more of the UN's Sustainable Development Goals (SDG's). Students leverage human-centered design and lean startup methodology to develop their prototypes and iterate on their solutions, while building an investable business case delivered through a final mission report and rocket pitch. The Bootcamp equips students with the necessary business acumen than enhances their entrepreneurial and intrapreneurial mindset, skillset, and toolset while providing a transformative opportunity to upgrade their modes of being, thinking and doing, and to challenge what is possible for themselves and the world around them.

Prerequisites: 40302112 & 30301123

30302232: Leadership Camp **1 Cr (0,3)**

A fundamental principle in teaching leadership is engaging students in experiential learning so they can mature into their leadership capacity. This course provides students with the diagnostic tools and strategic foundation for leading in organizations, communities, and society. Students will practice a set of tools and behaviors that will allow them to improve their self-efficacy and develop their leadership skills. The course provides a safe and supportive environment where students will learn from actual experience and apply the concepts in real life settings and situations. The emphasis will be on experiential learning and the application of leadership concepts.

Prerequisites:30302231 or 40302231

30301110: Remedial Arabic **3 Cr (3,0)**

The course aims to improve the student's abilities in reading and comprehending texts' primary, secondary, and missing ideas and how to extract them; recognizing words' equivalent meanings in texts; differentiating opinion from fact; recognizing similarities contained therein; comparing texts read with texts that are similar to them; and reasoning on the writer's attitude toward a topic by determining the implicit meanings contained. The course also aims to teach students the fundamentals of writing in Arabic, so that they can write a paragraph and a summary in a sound Arabic language that is free of spelling and linguistic errors,

expressing their thoughts and feelings while adhering to the correct language rules, using the correct conjunctions, punctuation marks, and Arabic styles, and developing speaking skills about their family and community while adhering to the correct language rules respecting his teacher and fellow students, responding to their queries with a declaration of his views and supporting it with facts. The course also aims to improve the student's listening abilities so that he can comprehend the speaker's main idea and supporting ideas, recognize the connections between them, and classify the ideas he heard with the ability to remember the right ones and be able to recognize strengths and weaknesses in the speaker's text.

Prerequisites: Arabic Placement test 0-59

30301111: Arabic Languge & Communication Skills **1 Cr (1,0)**

In this level, students should understand the main ideas of complex texts on both concrete and abstract topics. Further, they should understand a wide range of demanding, long texts, and recognize implicit meanings. Analytical thinking is stressed at this stage as students should use the language skills they have developed to engage in discussions about different topics.
They will also develop and use their writing skills in different genres. They will be asked to present reports, articles, and essays on a wide variety of topics. Students will also develop their media skills tools and learn how to critically talk about and respond to a wide range of media reports. In addition, functional syntax will be deployed and will serve the aforementioned skills and goals. Finally, compiled authentic teaching materials will be used in this level.

Prerequisites: Arabic Placement test score ≥60 or 30301110

University Elective Course Descriptions

30301130: Foundational French **1 Cr (3,0)**

By the end of this course, the student will be able to communicate in French using basic greetings, asking directions, writing short simple notes and emails, understanding simple question on familiar topics, and introducing him/herself to others. By the end of the course, the student will have attained a high-A1 level on the CEFR scale.

Prerequisites: None

30301131: French Language Level 1 **1 Cr (3,0)**

By the end of this course, the student will be able to use a wide variety of verb tenses and lexical items in Italian. The student will be able to understand simple questions in questionnaires on familiar topics, recognize phrases and content words related to basic personal and family information, make, and accept a simple apology, and write simple sentences about personal skills. By the end of the course, the student will have attained a low-A2 level on the CEFR scale.

Prerequisites: 30301130

30301232: French Language Level 2 **1 Cr (3,0)**

By the end of this course, students can understand the main points of clear standard speech on familiar subjects in work, school, leisure activities, etc. Students will be able to conduct conversations in most situations when travelling in a region where the language is spoken. They will be able to produce a simple and cohesive text on familiar subjects or subjects of personal interest. Students will be able to narrate an event, an experience or a dream, describe a desire or goal, and outline reasons or explanations behind a project or idea.

Prerequisites: 30301131

30301233: French Language Level 3 **1 Cr (3,0)**

By the end of this course, students will be able to understand the main ideas of concrete or abstract topics, including technical articles in the user's area of expertise. They will be able to communicate with a degree of spontaneity and fluency during a conversation with a native speaker. Students will be able to speak in a clear, detailed way on a number of subjects and express an opinion on current affairs, giving the advantages and disadvantages of the various options.

Prerequisites: 30301232

30301140: Foundational German Language **1 Cr (3,0)**

By the end of this course, the student will be able to communicate in German basic greetings, asking directions, writing short simple notes and emails, understanding simple question on familiar topics, and introducing him/herself to others. By the end of the course, the student will have attained a high-A1 level on the CEFR scale.

Prerequisites: None

30301141: German Language level 1 **1 Cr (3,0)**

By the end of this course, the student will be able to use a wide variety of verb tenses and lexical items in German. The student will be able to understand simple questions in questionnaires on familiar topics, recognize phrases and content words related to basic personal and family information, make, and accept a

simple apology, and write simple sentences about personal skills. By the end of the course, the student will have attained a mid-A2 level on the CEFR scale

30301150: Foundational Spanish **1 Cr (3,0)**

By the end of this course, the student will be able to communicate in Spanish using basic greetings, asking directions, writing short simple notes and emails, understanding simple question on familiar topics, and introducing him/herself to others. By the end of the course, the student will have attained a high-A1 level on the CEFR scale.

Prerequisites: None

30301160: Foundational Turkish **1 Cr (3,0)**

By the end of this course, the student will be able to communicate in Turkish basic greetings, asking directions, writing short simple notes and emails, understanding simple question on familiar topics, and introducing him/herself to others. By the end of the course, the student will have attained a high-A1 level on the CEFR scale.

Prerequisites: None

30301170: Foundational Italian **1 Cr (3,0)**

By the end of this course, the student will be able to communicate in Italian using basic greetings, asking directions, writing short simple notes and emails, understanding simple question on familiar topics, and introducing him/herself to others. By the end of the course, the student will have attained a high-A1 level on the CEFR scale.

Prerequisites: None

30301171: Italian Language Level 1 **1 Cr (3,0)**

By the end of this course, the student will be able to use a wide variety of verb tenses and lexical items in Italian. The student will be able to understand simple questions in questionnaires on familiar topics, recognize phrases and content words related to basic personal and family information, make, and accept a simple apology, and write simple sentences about personal skills. By the end of the course, the student will have attained a low-A2 level on the CEFR scale.

Prerequisites: 30301170

30301180: Chinese 1 **1 Cr (3,0)**

This course introduces students to the standard Chinese language and is designed for students with no or minimal previous background in spoken or written Chinese. Students in this course focus on learning essential vocabulary, practicing pronunciation, and understanding simple grammatical structures. This

knowledge prepares students to effectively communicate in Chinese on a limited range of topics related to everyday situations. Students practice listening and speaking in real-life situations, learn to read and write Chinese characters, and examine how culture and language interact in China. In-class activities and course assignments aim to assist students as they develop the oral proficiency and confidence necessary to initiate simple conversations. Out-of-classroom experiences such as field trips and guided interactions with native speakers supplement formal classroom instruction and provide ample opportunities for practical engagement.

Prerequisites: None

30301221: Development Academic Writing **1 Cr (3,0)**

This course develops students' abilities in academic writing. Focus will be given to sentence structure, paragraph writing, revision, punctuation, parallelism, and cohesion. Students, in conjunction with the instructor, will decide on a topic for the culminating paper, which will be developed throughout the semester. Students will have weekly writing assignments to develop the writing features being discussed. This course is meant for students who have passed or tested out of Advanced English in the Intensive English program.

Prerequisites:30301124 or by permission of the department

30301222: Research and Technical Writing **1 Cr (3,0)**

This course follows 30301220, or any student who has exempted out of English courses. Research and Technical Writing develops students' abilities in writing persuasive and explanatory texts in several formats: emails, reports, theses, among others. Focus will be given to establishing a clear thesis statement, developing a cohesive argument throughout the text, and creating a compelling summary. Various rhetorical devices will be discussed, such as alliteration, anaphora, hedging, hyperbole, litotes, metaphor, simile, etc. Students, in conjunction with the instructor, will decide on a topic for the culminating paper, which will be developed throughout the semester. Students will learn proper citation of quoted material according to APA or MLA standards. Students will have weekly writing assignments using various expository devices, such as descriptive essays, process essays, comparison essays, cause and effect essays, and problem and solution essays.

Prerequisites:30301124 or by permission of the department

30302123: Art Appreciation and Techniques **1 Cr (3,0)**

This course affords students a basic understanding of the main elements of art. It covers context and subject and analyzes the main arguments around aesthetics. The course also presents an overview of art history as it relates to other historical, sociocultural, and political aspects. The course aims to prepare students to be critically observant and to assess different symbolic values within artwork. The course is intended to raise students' awareness of the role of the arts and culture in their everyday lives regardless of students' areas of concentration and to promote an appreciation for, and interest in, the arts.

Prerequisites: -

30302124: Civil and Professional Culture **1 Cr (3,0)**

This course aims to consolidate and enhance students' knowledge of their native Jordan, the efforts of the Hashemite Kings in serving the Arab nation, its causes, and the establishment and development of the Jordanian state. It introduces students to the development of Jordanian political and constitutional life as well as to the emergence and development of Jordanian civil society. This course focuses on building students' professionalism and defining the concepts of professional work and ethics. Students will learn about legislation related to professional work as well as trade union institutions, professionalism, and labor.

Prerequisites: -

30302125: Rights and Responsibilities: Understanding Human Rights **1 Cr (3,0)**

This course aims to introduce students to the basic concept of human rights. Students will be expected to understand and internalize human rights values including tolerance; gender equality; and freedom from discrimination based on race, color, and ethnicity. The course aims to contribute to the full development of students' personalities by increasing their sense of dignity and appreciation for the rights of others. Students will also cultivate a sense of responsibility to promote and defend others' rights. Students will develop their advocacy skills by identifying key human rights issues in their local context and proposing courses of action to advance human rights.

Prerequisites: -

30302126: Introduction to Cultural Anthropology – Focus on Urban Anthropology **1 Cr (3,0)**

An introductory course in cultural anthropology with a focus on urban anthropology is an important course for students in various areas of study, since it offers them a formation in cross-cultural perspectives, whether on a local or global level. It is also increasingly important for students of the built environment and the local communities they work with. Through looking at different anthropological case studies, from Jordan, the region and globally, the course will consider such issues as the meaning of culture from an anthropological perspective and how it affects society; cultural diversity and sociocultural communication; the relationship of people to the land, their environment and their experiences of space and place; urban anthropology from a theoretical and historical context; changing city structures and "temporary" dwellings such as local refugee camps; ethics in social research and methods in ethnographic fieldwork; and qualitative data gathering, amongst other areas.

Prerequisites: -

30302127: Jerusalem, History and Civilization **1 Cr (3,0)**

This course focuses on introducing Jerusalem in terms of geography and history across the ages, and its religious and cultural importance since the Arab Islamic conquest in the period of the Rightly Guided Caliphs era and through the successive Islamic periods. Moreover, the course sheds light on the Ottoman period,

and the political, civilizational and administrative realities during that period, as well as treating the genesis of the movement of Jewish migration and settlement in the latter part of the Ottoman period. The course focuses on the practices of the British Mandate and its contribution to the attempts to Judaize the city, culminating with the Israeli occupation of western Jerusalem in 1948, and subsequently the Israeli occupation of East Jerusalem in 1967. Furthermore, light is shed on Israeli practices targeting the Arab identity of Jerusalem in terms of the demographic composition and holy places, and Islamic and Christian endowments. The course explains the Jordanian Hashemite efforts and its role in defending Jerusalem and safeguarding its Arab character.

Prerequisites: -

30302128: Jordan: History and Civilization **1 Cr (3,0)**

Jordan: History and Civilization course is concerned with introducing Jordan's history, sheds light on Jordan's geography, topography, climate, and natural resources, and is interested in studying Jordan's prehistoric history and ancient historical times. To examine Jordan's position and role in successive Islamic times. The course also highlights Jordan's administrative, economic, and social conditions during the Ottoman period 1516-1918, and is interested in studying Jordan's circumstances and conditions during the first world war of 1914-1918, the establishment of the Emirate of Eastern Jordan in 1921, and the most prominent political, economic, and social developments occurred in Jordan during the emirate in 1921-1946. It explained the importance of the achievements took place in Jordan during the reign of the Hashemite kings Talal bin Abdullah and Hussein bin Talal from 1951 to 1999. To study the origins and development of Jordanian constitutional authorities (executive, legislative and judicial), and Jordanian educational, economic, social, military and security institutions. Introducing Jordan's role in the Palestinian cause, the Jordanian-Palestinian unity phase 1950-1988, and Jordan's sacrifices in the Arab Israeli wars and their consequences and effects on it. It examined King Abdullah II's efforts in building and modernizing the Hashemite Kingdom of Jordan from 1999 to 2021. Assess the Jordanian state's march in its centenary, and a future look.

Prerequisites: -

30302133: Principles of Management **1 Cr (3,0)**

This course introduces students to the management process of a business organization. The course emphasizes basic concepts and functions of management by examining the processes of planning, organizing, leading, and controlling. Students will develop the skills and tools required to work with people and resources to achieve organizational goals. Students will also develop their strategic management and decision-making capacities.

Prerequisites: -

30302135: Principles of Accounting **1 Cr (3,0)**

This course provides students with the basic accounting principles, concepts, and terminology. Students will become familiar with the basic financial statement analysis. Students will be able to understand and apply the basic elements of financial accounting information such as assets, liabilities, revenue, and expenses. Students will be able to understand and interpret income statement, balance sheet, and cash flow statement

Prerequisites: -

30302136: Principles of Economics **1 Cr (3,0)**

This course covers the basic concepts of both microeconomics and macroeconomics. The first part of the course looks at resource allocation under scarcity, supply and demand analysis, and the theory behind consumer behavior. The course further examines production decisions taken by firms under different types of market structure such as perfect competition, oligopoly, and monopoly. The second part of the course examines the wider economic phenomena and introduces the basic principles of the aggregate economy, such as determinates of national product, inflation, unemployment, and fiscal and monetary policy.

Prerequisites: -

30302237: Free Choice Elective **1 Cr (3,0)**

The free choice elective is designed to offer students the opportunity to explore a subject of interest under the supervision of a faculty member. The course may include coursework offered by online platforms (i.e. HTUx, Coursera), directed readings, applied projects, independent research projects, or other appropriate activities.

Prerequisites: -

40302233: Business Analytics **1 Cr (3,0)**

The Business Analytics course provides students with the tools they need to put data to work; how to set up experiments, how to collect data, how to learn from data and make decisions to how to navigate the organizational, legal, and ethical issues involved in data-based decision making. The course teaches widely used frameworks of business analytics: biases, experimentation, descriptive analytics, prescriptive analytics, predictive analytics. Students then implement the frameworks they have learned through assignments. The course includes case studies and examples from Google, Netflix, and others. The assignments and cases focus on interpreting the results of analysis and taking decisions based on those analysis. The course does not require coding.

Prerequisites: -

40302221: Speech and Debate **1 Cr (3,0)**

The Speech and Debate course aims to provide students with linguistic and basic debate skills in Arabic. This course aims to improve the student's level of Arabic grammar as well as his vocabulary, linguistic structures, and linguistic style so that he can address political, social, and ethical issues through scientific debates and discourses presented in the classroom, by familiarizing him with unique and authentic models of ancient and modern discourses so that he can understand them. And walk according to the structure of his own speech. The course is also designed to teach students research skills, independent and collaborative learning, logical argumentation, problem-solving skills through critical and creative thinking, organizing ideas, presentation skills, and confidence. The course contains theoretical sections that describe debate, public speaking, and other historical and contemporary speech forms. Examples include debating forms, speaker roles and arguments, developing team positions, interventions, and response speeches based on active learning techniques focused on discussion, working groups, and communication.

Prerequisites:None

30302133: Principles of Management **1 Cr (3,0)**

This course introduces students to the management process of a business organization. The course emphasizes basic concepts and functions of management by examining the processes of planning, organizing, leading, and controlling. Students will develop the skills and tools required to work with people and resources to achieve organizational goals. Students will also develop their strategic management and decision-making capacities.

Prerequisites: -

30301223: Introduction to Translation **1 Cr (3,0)**

This course introduces students to the standard Chinese language and is designed for students with no or minimal previous background in spoken or written Chinese. Students in this course focus on learning essential vocabulary, practicing pronunciation, and understanding simple grammatical structures. This knowledge prepares students to effectively communicate in Chinese on a limited range of topics related to everyday situations. Students practice listening and speaking in real-life situations, learn to read and write Chinese characters, and examine how culture and language interact in China. In-class activities and course assignments aim to assist students as they develop the oral proficiency and confidence necessary to initiate simple conversations. Out-of-classroom experiences such as field trips and guided interactions with native speakers supplement formal classroom instruction and provide ample opportunities for practical engagement.

Prerequisites: 30301124, or by permission of the department

30302134: Strategies for Industry Competitiveness: Tools & Techniques **1 Cr (3,0)**

This course covers the role of policy in industry competitiveness. The course examines firm strategies, cluster vitality, and the quality of the business environment in which competition takes place, all of which can determine a nation’s productivity.

Prerequisites: -

School Requirements Course Descriptions

30303110: Remedial Math **2 Cr (2,0)**

This course serves as an introductory course designed specifically for students that lack a foundational knowledge in mathematics required to pursue a post high school degree (HNC, HND, or Bachelor's). This course revisits topics typically covered in high school for students that failed to pass the mathematics placement test upon the admission process. The topics included in this unit are numbers, algebra and functions, geometry, and vectors. (Exempted if Math placement test (1) score ≥60%).

Prerequisites: Placement test -

40303130: Fundamentals of Computing **4 Cr (3,3)**

This course provides a comprehensive route to developing an in-depth exposure to personal computers, hardware, a range of operating systems, and in-depth programming in C. Students learn the functionality of various hardware and software components and best practices in maintenance and safety issues as well as programming in C, including variables, operations, functions, structures, and pointers.

Prerequisites: -

30303111: Functional Math **3 Cr (3,0)**

This course introduces a transitional stage for the study of subsequent mathematics subjects in other schools. Among the topics included in this unit are algebra, functions and graphs, differentiation, integration, and matrices. It strengthens the problem formulation skills, i.e., the ability to translate real application problems into a series of mathematical processes. (Exempted if Math placement test (2) score ≥80%).

Prerequisites: 30303110

30303112: Functional Physics **3 Cr (3,0)**

This course demonstrates understanding and application of essential physics topics such as: Physics and measurements, motion in one dimension, vectors, motion in two dimensions, the laws of motion, forces and motion, applications of Newton's laws (projectile, angular velocity, etc.), energy of a system, static equilibrium, and electricity.

Prerequisites: --

00101100: Introduction to Engineering Drawing **1 Cr (0,1)**

This course provides the fundamentals of engineering graphics and drawing. Among the topics covered are: drawing of orthographic, isometric and auxiliary projections, sectioning, dimensioning, scaling, documentation. Students learn and use the interface, structure, and commands of latest version of computer-aided design (CAD) software.

Prerequisites: -

00103101: STEM Lab I **1 Cr (0,3)**

This course develops the basic skills in the fields of science, technology, engineering, and mathematics through a set of practical experiments, covering mechanical, electrical, electronics, automation, mechanics of materials, robotics, computer applications, and process control.

Prerequisites: -

00102102: STEM Lab II **1 Cr (0,3)**

This course provides students with a modern hands-on technical perspective of STEM education as they are applied in professional settings. The lab is equipped with state-of-the-art educational technologies in fields related but not limited to electromechanical systems, robotics, pneumatic systems, automation, image processing, sensor installation and calibration, and material manufacturing processes.

Prerequisites: 00103101

00101103: Workshop I **2 Cr (0,6)**

This course develops the following basic skills: Hand filing, turning, welding, piping and plumbing, carpentry, brick laying, constructional works, surveying measurements, sheet metal fabrication, household electric circuits, and installation of simple computer networks.

Prerequisites: -

00101104: Workshop II **1 Cr (0,3)**

This course covers hands on training on manual and electric driven tools, electric arc welding, spot welding, resistance welding, sand casting, sheet metal forming, longitudinal lathing, longitudinal and inclined turning, and metal milling.

Prerequisites: 00101103

00102205: Advanced Workshop for Energy Engineers **1 Cr (0,3)**

This lab focuses on practical aspects of solar and wind energy systems. It covers the components of each system including different types of inverters, charge controllers and batteries. In addition it covers the use of

advanced measurement tools such as power analyzers, clamp meters and irradiance temperature meter. The students end up designing a PV system using software tools and then constructing this system and operating it.

Prerequisites: 00101104

00103110: Engineering Math **4 Cr (3,3)**

This course aims to develop students' skills in the mathematical principles and theories that are directly applicable to the engineering industry. Students will be introduced to mathematical methods and statistical techniques that enable them to analyze and solve problems within an engineering context. Among the topics included in this course are: Arithmetic and geometric progressions; exponential, logarithmic, circular, and hyperbolic functions; mean and standard deviation of grouped data, linear regression; Binomial and normal distributions; sine waves and their applications, trigonometric and hyperbolic identities; vector functions; and the use of differential and integral calculus in solving engineering problems.

Prerequisites: 30303111

00102111: Engineering Science **4 Cr (3,3)**

This course introduces the fundamental laws and applications of the physical sciences within engineering and how to apply this knowledge to find solutions to a variety of engineering problems. Among the topics included in this course are: international system of units, interpreting data, static and dynamic forces, fluid mechanics and thermodynamics, material properties and failure, and A.C./D.C. circuit theories.

Prerequisites: 30303112

00101112: Engineering Design **4 Cr (3,3)**

This course introduces the methodical steps that engineers use in creating functional products and processes; from a design brief to the work, and the stages involved in identifying and justifying a solution to a given engineering need. Among the topics included in this course are: Gantt charts and critical path analysis, stakeholder requirements, market analysis, design process management, modelling and prototyping, manufacturability, reliability life cycle, safety and risk, management, calculations, drawings and concepts and ergonomics.

Prerequisites: 00101100

00103213: Further Mathematics **4 Cr (3,3)**

This course introduces additional mathematical topics to students, advancing their knowledge of the underpinning mathematics gained in the *Engineering Mathematics* course. The purpose of this course is to prepare students to analyze and model engineering situations using mathematical techniques. Among the topics included in this course are number theory, complex numbers, matrix theory, linear equations, numerical integration, and graphical representations of curves for estimation within an engineering context. Furthermore, this course expands students' knowledge of calculus to discover how to model and solve engineering problems using first and second order differential equations.

Prerequisites: 00103110

00102220: Managing A Professional Engineering Project **4 Cr (3,3)**

This course introduces students to the techniques and best practices required to successfully create and manage an engineering project designed to identify a solution to an engineering need. Among the topics covered in this course are: roles, responsibilities and behaviors of a professional engineer, planning a project, project management stages, devising solutions, theories and calculations, management using a Gantt chart, evaluation techniques, communication skills, and the creation and presentation of a project report.

Pre-Requisite: 00101112

00103375: Introduction to Artifical Intelligence and Data Science **3 Cr (2,3)**

This course gives an introduction to Artificial Intelligence and Data Science. It provides an overview of AI development history, explains AI ethics, and discusses future trends. The course reviews basic math concepts in Calculus, Linear Algebra, and Probability Theory. The math exposure will be limited, and only essential concepts will be discussed. The course will introduce the following topics: Data Visualization, Data Pre-Processing, Missing Data, Normalization and Standardization, Log Transformation, Cross and Auto Correlation, Linear and Nonlinear Regression, Clustering and Classification, Machine Learning, Artificial Neural Networks, Deep Learning, Supervised and Unsupervised learning. Different examples and case studies will be provided and discussed. The course will introduce Python with its most popular packages (NumPy, Pandas, Matplotlib, Scikit-learn, and TensorFlow) and introduce available platform environments. This is a hands-on and project-based course and will include a laboratory that will enhance the students' coding skills.

Prerequisites: 40303130 & 00103110

Program Requirements Course Descriptions

00102321: Professional Engineering Management **4 Cr (3,3)**

This course aims to continue building up on the knowledge gained by Managing a Professional Engineering Project course, to provide students with the professional standards for engineers and to guide them on how to develop the range of employability skills needed by professional engineers. Among the topics included in this course are: engineering strategy and services delivery planning, the role of sustainability, Total Quality Management (TQM), engineering management tools, managing people and becoming a professional engineer.

Prerequisites: 00102220

00103230: Electrical and Electronic Principles **4 Cr (3,3)**

This course provides students with a good and wide-ranging grasp of the fundamental principles of electrical and electronic circuits and devices. Topics included in this course are: Analysis of simple

circuits with constant voltages and currents, using circuit laws, Kirchhoff's and Thevenin's laws, and the superposition principle; analysis of simple circuits with sinusoidal voltages and currents; basis of semiconductor action, and its applications to simple electronic devices, such as junction diode, Zener diode, light emitting diode, bipolar transistor, junction field effect transistor (FET), and metal oxide semiconductor FET (MOSFET); difference between analogue and digital electronics, and simple applications of each.

Prerequisites: 00102111

00103240: Electronic Circuits and Devices **4 Cr (3,3)**

This course introduces students to the use of electronics manufacturers' data to analyze the performance of circuits and devices, the operational characteristics of amplifier circuits, the types and effects of feedback on a circuit performance, and the operation and application of oscillators. Students will also be introduced to the application of testing procedures to electronic devices and circuits, and the use of the findings of the tests to evaluate their operation. Among the topics included in this course are: Power amplifiers (classes A, B, and AB); operational amplifiers (inverting, non-inverting, differential, summing, integrator, differentiator); feedback types, such as open, closed, positive, and negative feedback; frequency, stability, frequency drift, distortion, amplitude, wave shapes, and testing procedures.

Prerequisites: 00103230

00103232: Further Electrical, Electronic and Digital Principles **4 Cr (3,3)**

This course focuses on using appropriate mathematical techniques to solve a range of electrical and electronic problems by applying appropriate circuit theorems and computer simulation tools. Topics include steady state circuit analysis techniques such as mesh and nodal analysis, using complex notation and phasor diagrams to analyze single and three-phase AC circuits. Terminology related to power calculations such as instantaneous power, power factor, real and reactive power are summarized based on the power triangle representation. The course also briefs the characteristics of non-linear circuits including diodes and transistors.

Prerequisites: 00103230, 00103213

00103331: Industrial Power, Electronics and Storage **4 Cr (3,3)**

This course reviews the main issues related to energy demand and production, efficiency measures and policies, and interfacing between renewable energy sources and the grid. It reviews the historical perspective of energy production and demand, their environmental effects, and the necessity of renewable, or sustainable, energy sources. Energy auditing and management skills are delivered through this course, discussed through examples of energy efficiency in buildings and electric vehicles. Renewable energy sources are then investigated in detail, concentrating on their theoretical models, control circuits, and grid interfacing techniques. The impact of connecting renewable energy sources to the grid is also discussed, introducing the principle of smart grid.

Prerequisites: 00103240

00103250: Instrumentation and control systems **4 Cr (3,3)**

This course discusses the main components of instrumentation and measurements systems including various types of sensing elements (such as: displacement, speed, pressure, temperature and strain), variable conditioning and signal processing techniques, in addition to signal representation methods. The course also introduces the concepts and terminology of control systems, such as: open and closed loop systems, discrete and analogue systems, and focuses on process controllers. Proportional-Integral-Differential (PID) controllers are investigated in details according to their mathematical models. Multiple practical experiments and simulations exercises are conducted throughout the course demonstrating conventional instrumentation circuits.

Prerequisites: 00103230

00103333: Electrical Machines **3 Cr (2,3)**

This course provides the theoretical background of standard electrical machines. It presents the main principles of electro-magnetism, reluctance circuits and transformers operation. It provides detailed analysis of common alternating-current machines such as single-phase and three-phase motors. Different types of machines such as induction and synchronous types are compared in terms of operation, speed-torque characteristics, and applications.

Prerequisites: 00103232

00101240: Fundamentals of Thermodynamics and Heat Engines **4 Cr (3,3)**

This course introduces the principles and concepts of thermodynamics and its application in modern engineering. Among the topics included are: Forms of energy and basic definitions, properties of pure substances, first law of thermodynamics, polytrophic processes, application of steady flow energy equation to plant equipment, principles of heat transfer, application of the second law of thermodynamics and efficiency improvements of heat engines.

Prerequisites: 00102111

00101241: Fluid Mechanics **4 Cr (3,3)**

This course introduces fluid mechanics principles used in mechanical engineering applications. Among topics included in this course are: pressure and force, submerged surfaces, fluid flow theory, continuity equation, energy equation, aerodynamics, and hydraulic machinery, characteristics of Newtonian and non- Newtonian fluids, losses in pipes and conduits, operating principles of various water turbines and pumps.

Prerequisites: 00102111

00101343: Further Thermodynamics **4 Cr (3,3)**

The aim of this course is to build on the techniques explored in Fundamentals of Thermodynamics and Heat Engines course, to develop further students' skills in applied thermodynamics by investigating the relationships between theory and practice. Among the topics included in this unit are: irreversibility, heat pumps and refrigeration, performance of air compressors, Rankine cycle and steam power plants, Brayton cycle and gas turbine power plants.

Prerequisites: 00101240

00101442 : Heat and Mass Transfer **3 Cr (2,3)**

The course introduces the governing laws and applications of heat and mass transfer. Among the topics included in this course are: Basic concepts and modes of heat transfer, Heat conduction equation, Steady heat conduction, Forced convection: External and internal flow, free convection, Heat exchangers, mass transfer: Diffusion process, Fick's law, concept of permeability.

Prerequisites: 00101240

00101345 : Heating, Ventilation and Air Conditioning (HVAC) **3 Cr (2,3)**

This course introduces the most important HVAC systems and their supporting elements, and the underpinning science that is currently used in many different buildings around the world. Among topics included in this course are: Psychrometric principles, thermal comfort, air conditioning processes, inside and outside design conditions, heating and cooling load calculations, infiltration, ventilation rates, solar gain, design of heating and air conditioning systems, selection of HVAC equipment and components, codes and standards.

Prerequisites: 00101240

00101366: Lean manufacturing **4 Cr (3,3)**

The aim of this course is to introduce the principles and processes of lean manufacturing and explore the tools and techniques that are applied by organizations practicing lean. Among the topics included in this course are: scoping and defining lean manufacturing, the benefits and challenges of adopting Lean, The Toyota Production System (TPS), common tools and techniques associated with lean manufacturing and process improvement, and the most appropriate improvement tool(s) to tackle a problem.

Prerequisites: 00101112

00102330: Energy Resources and Conversion **3 Cr (3,0)**

This course introduces the students to the fundamentals of energy conversion principles and systems, and covers contemporary energy issues and challenges. Topics covered include: Global energy demand and energy mix, future energy outlook, environmental impacts, Crude oil and petroleum products, natural gas, oil shale, coal, nuclear energy, renewable energy, final energy use, engines, power plants,

cogeneration, combustion, boilers and furnaces, heat exchanges and heat recovery, electrical power transmission and distribution systems, energy storage.

Prerequisites: 00101240

00102340 : Renewable Energy Systems and Technologies **3 Cr (2,3)**

This course introduces students to renewable energy resources and technologies, including the assessment of the benefits and limitations of each of them. Topics covered include: Renewable energy resource assessment, wind energy, solar thermal energy systems, solar photovoltaic systems, hydropower, geothermal energy systems, wave energy, biogas and biofuels, grid integration, legislative frameworks, economics of renewable energy.

Prerequisites: 00102111

00102541: Photovoltaic Systems **3 Cr (2,3)**

This course covers an in-depth analysis of solar photovoltaic systems and technologies and focuses on the practical design considerations. Topics covered include: Solar radiation characteristics, solar insolation over collecting surfaces and shading analysis, categories of photovoltaic systems, specification and selection of solar PV modules, types and characteristics of grid-connected inverters, fixed and tracking mounting structures, design of grid-connected PV systems using software tools, energy yield calculations, economic feasibility, testing and commissioning, operation and maintenance, off-grid PV systems, hybrid PV-systems, and storage technologies.

Prerequisites: 00103232 & 00102340

00102531: Energy Economics, Policy, and Regulations **3 Cr (3,0)**

This course is designed to equip the student with basic economic analysis tools and to familiarize him with the current and evolving legislative and policy framework. Topics covered include: Engineering economic analysis, time-value of money, cash flow, measures of economic feasibility, life cycle analysis, investment assessment criteria and options, energy demand and supply, national energy balance, energy pricing and electricity tariff structures, national energy strategies, national energy legislations, energy project models and contracts (EPC, BOT, DBO).

Prerequisites: 00102330

00102532: Energy Efficiency and Management **3 Cr (2,3)**

This course prepares the student to conduct detailed energy audits, recommend energy saving measures, and design effective energy management plans. Topics covered include: Need for energy management, types of energy audits, planning and conducting energy audits, energy audit reports, measurement devices and instruments, performance contracting, energy purchasing, energy accounting and benchmarking, codes and standards, energy efficiency in various systems (electrical, lighting, HVAC, building envelope, boilers and steam networks, motors and drives, motors, pumps and fans, compressed air systems, heat recovery, thermal energy storage), energy management systems (ISO 50001).

Prerequisites: 00102330

00102522: Maintenance Engineering **3 Cr (3,0)**

This course introduces the concepts of Reliability, maintainability, availability, and safety of products and systems, with practical applications and case studies. Topics covered include: Building and analyzing reliability models using block diagrams, Fault Tree Analysis (FTA), Failure Mode & Effect Analysis (FMEA), concepts and methods of maintenance planning and management with a focus on corrective and preventive maintenance, cost estimation and scheduling of maintenance activities, forecasting of spare parts needed for equipment maintenance, inventory control models, introduction to computerized maintenance management systems.

Prerequisites: 00102321

00102542: Solar Thermal Systems **3 Cr (2,3)**

This course aims to qualify the student to design and analyse a variety of solar thermal systems taking into consideration theoretical and practical aspects. Topics covered include: Properties of solar radiation, materials and thermal fluids, types of solar thermal systems, specifications of solar collectors, performance characteristics, solar water storage tanks, solar control units, circulation systems, codes and standards, solar thermal power plants, industrial solar systems, solar cooling applications, swimming pool heating applications, solar desalination applications.

Prerequisites: 00101242

00102543: Wind Energy **3 Cr (2,3)**

This course covers the fundamentals of the design, testing, and operation aspects of modern wind turbine systems. Topics covered include: Wind characteristics and resources, wind resource assessment, wind measurements and instrumentation, aerodynamics of wind turbines, blade design, wind turbine mechanics and rotor dynamics, electrical aspects, materials and components of wind turbines, testing and performance, control systems, wind energy integration and economics.

Prerequisites: 00103333

00102544: Green Buildings **3 Cr (2,3)**

This course introduces sustainability concepts in new and existing buildings and prepares the student for international certification in green buildings. Topics covered include: Green buildings rating systems, LEED concepts and categories, site sustainability strategies, water efficiency and wastewater technologies, energy performance, building simulation, renewable energy in buildings, fundamental and enhanced commissioning, sustainable building materials, indoor air quality, lighting and thermal comfort, innovative design case studies.

Prerequisites: 00102111

00102545: Sustainability **3 Cr (3,0)**

This course provides an in-depth discussion of modern sustainability concepts, challenges, and strategies in a global perspective. Topics covered include: Natural cycles and eco-systems, United Nations millennium goals, national and regional sustainability planning, climate change and greenhouse gas management, energy-water-food nexus, pollution and waste, environmental justice, corporate and organizational sustainability management, ISO 14001, ISO 26000.

Prerequisites: 00102340

00102550: Energy Storage **3 Cr (2,3)**

This course introduces the student to state-of-the-art energy storage technologies and systems, and the design and integration aspects in modern power systems. Topics covered include: Role of storage in modern power systems, technologies of energy storage systems, mechanical energy storage, electromagnetic energy storage, Lithium ion batteries, Lead acid batteries, flow batteries, sodium ion batteries, battery management systems, protection technologies, on-grid and off-grid operation control technologies, design and economic analysis of storage systems, grid-impact considerations, applications in microgrids.

Prerequisites: 00103331

00102551: Smart Grids **3 Cr (2,3)**

This course provides an in-depth introduction to the aspects and consideration governing the evolution of conventional electrical networks into smart grids. Topics covered include: anatomy of smart grids, smart grid infrastructure, smart grid operation, communication, cyber security, IEC 61850, power system protection applications, demand side management applications, energy storage applications, integration of electric vehicles.

Prerequisites: 00103331

00102552: Electric and Hybrid Vehicles **3 Cr (2,3)**

This course introduces the fundamentals, principles and design of hybrid and electric vehicles. Among the topics covered are: components and operation of hybrid and electric vehicles, sizing the drive system, energy storage devices and challenges, battery and charging technologies, energy management systems, vehicle dynamics and transmission, performance analysis.

Prerequisites: 00103333

00102553: Energy Simulation in Buildings **3 Cr (2,3)**

This course builds on the knowledge of the student in energy systems used in buildings through the application of modern software tools to optimize energy efficient design strategies. Topics covered include: integrative modelling methods, energy models, model formulation process, processing the energy equations, fluid and heat flow, HVAC systems, on-site renewable energy, passive design aspects, practical applications.

Prerequisites: 00101545

00102523: Health, Safety, and Environment **1 Cr (1,0)**

The course aims to qualify the student for international certification in health and safety and environmental awareness at work. Topics covered include: Fundamentals of health and safety, the responsibility for health and safety, risk assessment and control, work equipment, transport safety, working with electricity, fire safety, manual handling, repetitive activity, hazardous substances, practical risk assessment planning activity, environmental awareness, pollution impact assessment, dealing with emergencies.

Prerequisites: 00102321

00102593: Special Topics in Energy Engineering **3 Cr (3,0)**

This course will cover a thorough study of a state-of-the-art topic on one of energy engineering fields that is required by industry. The course content will vary each and will focus on concepts that are not addressed in current course selections.

Prerequisites: Department Approval

00102490: Research Project for Energy Engineers **4 Cr (2,6)**

This course introduces the skills necessary to deliver a complex, independently conducted research project that fits within an energy engineering context. Topics included in this course are: Finding a research problem, project proposal, selection of project approach, literature review, data analysis and interpreting findings, project management and key milestones, reporting the research, project oral presentation, and research publication methods.

Prerequisites: Department approval

00102494: Capstone Project for Energy Engineers **3 Cr (1,6)**

This course focuses on how choose and refine capstone project based on feedback from faculty, peers and partner organizations. It introduces technical methods for analyzing, designing, prototyping, synthesizing, troubleshooting, and testing a project relevant to energy engineering. The students practice project documentation, formal design review presentations, oral defense of the project, and writing a final report.

Prerequisites: Department approval

00102496: Practical Training for Energy Engineers (PATH) **18 Cr (0,40)**

The practical training program is the bridge between academic study and industry. It is designed to transform the apprentice from a student to an employee. The main objective is to improve graduate readiness for full-time employment upon graduation. It is an 8-month work placement opportunity for a student where they apply the technical knowledge obtained during study and develop their workplace skills to match high international standards. The program is designed to allow updated monitoring of the apprentice progress and development.

Prerequisites: Department approval

00103534: Power Systems **3 Cr (2,3)**

This course covers an introduction to electrical energy sources and power system components. Review of 1-phase AC circuits, 3-phase AC circuits, complex power, and modeling of transformers and generators. Power system representation using graphical and mathematical methods. The one-line diagram. The concept of Per unit quantities. Per unit calculations applied to power systems. Transmission line Modeling: series impedance and shunt admittance. Transmission lines analysis: currents, voltages and power relationships at both ends, voltage regulation and efficiency, reactive power compensation. Power flow problem and analysis using Gauss-Seidel method, Newton-Raphson technique, decoupled power flow. Symmetrical 3-phase fault calculations. Symmetrical components. Unsymmetrical fault calculations.

Prerequisites: 00103232

Version Feb 2023

Energy Engineering Program Map (Oct. 2022)

HTU جامعة الحسين التقنية
Al Hussein Technical University