



German Jordanian University

School of Sustainable Systems Engineering

Department of Civil and Environmental Engineering

Sustainable Infrastructure Systems Engineering

Study Plan 2026

I. Program Objectives

The Sustainable Infrastructure Systems Engineering program emphasizes the integration of engineering principles, sustainability concepts, and modern technologies to address current and future infrastructure challenges. The program prepares graduates to:

- a. Provide technical knowledge of sustainable infrastructure systems engineering principles, supported by strong foundations in mathematics, science, computing, and engineering fundamentals, with emphasis on sustainable design, resilient infrastructure, environmental stewardship, and smart systems.
- b. Develop the skills required to analyze, model, design, and manage sustainable infrastructure projects, and to formulate engineering solutions that consider technical, environmental, economic, and social factors.
- c. Develop the ability to organize, communicate, and present engineering information effectively through oral, written, graphical, and digital means.
- d. Provide sufficient breadth and depth for successful graduate studies, professional practice, research, innovation, and lifelong learning in the evolving field of sustainable infrastructure.
- e. Provide an appreciation for the multidisciplinary nature of infrastructure systems and the broad spectrum of issues arising in professional practice, including sustainability, ethics, leadership, teamwork, safety, resilience, economics, and societal impact.

II. Learning Outcomes

Sustainable Infrastructure Systems Engineering provides bachelor's students with an understanding of fundamental engineering, sustainability, and infrastructure management concepts, methodologies, and technologies as demonstrated by:

- a. An ability to apply knowledge of mathematics, science, engineering, and sustainability principles to infrastructure systems.
- b. An ability to design and conduct experiments, analyze and interpret data, and utilize modern tools for infrastructure assessment and decision-making.
- c. An ability to design sustainable infrastructure systems, components, or processes that meet technical, environmental, economic, and societal needs.
- d. An ability to function effectively in multidisciplinary and collaborative teams.
- e. An ability to identify, formulate, and solve complex engineering problems related to sustainable infrastructure systems.
- f. An understanding of professional, ethical, environmental, and social responsibilities in engineering practice.
- g. An ability to communicate effectively with technical and non-technical audiences.
- h. A broad education necessary to understand the impact of sustainable infrastructure solutions in global, environmental, economic, and societal contexts.
- i. A recognition of the need for, and an ability to engage in, lifelong learning and continuous professional development.
- j. A knowledge of contemporary issues related to sustainability, climate change, smart cities, renewable resources, and resilient infrastructure systems.
- k. An ability to use modern engineering techniques, digital technologies, modeling tools, and data-driven approaches necessary for sustainable infrastructure engineering practice.

Course Delivery Methods

Courses are in one of the following three methods:

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

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

- **Blended (BLD) Method**

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

- **Online (OL) Method**

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

III. Admission Requirements

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

- General secondary school certificate with a minimum score of 80%

Placement Tests

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

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

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

IV. Degree Requirements

The requirements to obtain a B.Sc. degree in Civil and Environmental Engineering are the following:

- Complete the 164-credit hour program.
- A minimum of 12 credit hours of elective courses are to be taken at a partner university in Germany.
- Complete International Internship.

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

VI. Classification	Credit Hours			ECTS		
	Compulsory	Elective	Total	Compulsory	Elective	Total
University Requirements	21	6	27	25	6	31
School Requirements	31	0	31	55	0	55
Program Requirements	96	12	108	185	20	205
Total	148	18	166	265	26	291

Course Delivery Method	Credit Hours	Percentage
Online Courses	18	10.8%
Blended Courses	67	40.4%
Face-to-Face Courses	81	48.8%
Total	166	100%

Course Code meanings

- THREE letters indicate the program name (CEE Civil and Environmental Engineering)
- Four Digits code:
 - o First digit for year level.
 - o The second digit indicates the field of study.
 - (1) Basic Engineering Courses
 - (2) Structures.
 - (3) Transportation & Pavement.
 - (4) Geotechnical Engineering.
 - (5) Construction Management.
 - (6) WEF Engineering.
 - (9) Graduation projects.
 - o The last two digits are sequential digits.

1. University Requirements: (27 credit hours)

1.1. Compulsory: (21 credit hours)

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

1.2. Elective: (6 credit hours) (Two courses out of the following)

Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
				Lect.	Prac.		
-	University Elective 1	2	2	1	1	BLD	
-	University Elective 2	2	2	1	1	BLD	
-	University Elective 3	2	2	1	1	BLD	
Minimum required		6	6	6	0		

The university elective courses can be found at the following link:

<https://www.gju.edu.jo/content/departement-basic-education-18102>

2. School Requirements: (31 credit hours)

Course ID	Course Name		Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
					Lect.	Prac.		
GERL201B1	German III	B1-Track	3	4	6	-	F2F	GERL102B1 or GERL102B2
GERL201B2		B2-Track						GERL102B2
GERL202B1	German IV	B1-Track	3	6	9	-	F2F	GERL201B1 or GERL201B2
GERL202B2		B2-Track						GERL201B2
MATH101	Calculus I		3	5	3	-	BLD	MATH0099
MATH102	Calculus II		3	5	3	-	F2F	MATH101
MATH203	Applied Mathematics for Engineers		3	5	3	-	F2F	MATH102
MATH205	Differential Equations		3	5	3	-	F2F	MATH102
PHYS103	Physics I		3	5	3	-	BLD	-
PHYS104	Physics II		3	5	3	-	F2F	PHYS103
PHYS106	General Physics Lab		1	2	-	3	BLD	PHYS103, PHYS104 ^{co}
CHEM103	General Chemistry I		3	5	3	-	F2F	-
IE0141	Engineering Workshops		1	4	0	3	BLD	
ME0111	Computer-Aided Engineering Drawing		2	4	-	6	BLD	CS116
Total			31	55				

3. Program Requirements (108 credit hours)

3.1. Program Requirements (Compulsory): (96 credit hours)

Course ID	Course Name		Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
					Lect.	Prac.		
GERL301B1	German V	B1-Track	3	6	9	-	F2F	GERL202B1 or GERL202B2
GERL301B2		B2-Track						GERL202B2
GERL302B1	German VI	B1-Track	3	6	6	-	F2F	GERL301B1 or GERL301B2
GERL302B2		B2-Track						GERL301B2
CHEM106	General Chemistry lab		1	2	0	3	BLD	CHEM103
CEW2101	AI applications and Data Modeling for Civil Engineering		2	4	3	0	BLD	MATH101
CEW2102	Computer Aided Mathematics for CEW		2	4	2	2	BLD	CEW2101 ^{co}
CEW2103	General Chemistry 2		3	5	3	0	BLD	CHEM103
CEW2104	Engineering Professional Development		3	5	3	0	BLD	ENGL0099
MECH2102	Statics and Strength		3	5	3	0	F2F	PHYS103
CEW2201	Building Materials		3	5	2	3	BLD	---
CEW2401	Engineering Geology		3	5	2	3	F2F	---
CEW2601	Thermal Fluids Science		3	5	3	0	F2F	PHYS103
CEW2602	Hydraulics and Hydrology		4	6	3	3	BLD	CEW2601
CEW2603	Introduction to Renewable Energy		3	5	3	0	F2F	CEW2601
CEW3201	Analysis of Structures and Modeling		3	5	3	0	BLD	MECH2102

CEW3202	Dynamics & Seismic Analysis of Structures	3	5	3	0	BLD	CEW3201
CEW3301	Surveying and remote sensing	3	5	2	3	BLD	CEW2101
CEW3302	Traffic Engineering and Smart Mobility Analytics	3	5	3	0	F2F	CEW3301
CEW3401	Smart Geotechnical Engineering	3	6	2	3	BLD	CEW2401& MECH2102
CEW3601	Wastewater Treatment Engineering	3	5	2	3	BLD	CEW2602
CEW3602	Introduction to the WEFE Nexus	1	2	1	0	F2F	CEW2603
CEW3603	Sustainable Engineering and Entrepreneurship	3	5	3	0	OL	CEW3602
CEW4801	Field Training in Jordan	0	6	0	160 Hrs	F2F	Passing 90 CHrs
CEW4802	International Internship in Germany	12	30	0	20 weeks	F2F	Passing 115 CHrs
CEW5201	Smart Design of Structures 1	3	5	3	0	F2F	CEW3201& CEW2201
CEW5202	Smart Design of Structures 2	3	5	3	0	BLD	CEW5201
CEW5301	Pavement Systems and Design	3	5	3	0	F2F	CEW3302
CEW5401	Foundation Engineering	3	5	3	0	F2F	CEW3401
CEW5501	Building Information Modeling & Sustainable Construction	3	5	3	0	OL	CEW3201& CEW3302
CEW5502	Engineering Economics, Management, and Digital Applications	3	5	3	0	OL	CEW3603
CEW5601	Climate Change Adaptation & Ecosystem Services	2	4	3	0	F2F	CEW3601
CEW5602	WEFE Nexus Modeling and Decision Tools	3	5	3	0	F2F	CEW2603
CEW5901	Graduation project 1	1	4	0	3	BLD	Passing 120 CHrs
CEW5902	Graduation project 2	2	5	0	6	BLD	CEW5901
Total		96	185				

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

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

Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
				Lect.	Prac.		
CEW4200	Rehabilitation of Structures	3	5	3	-	BLD	BSC001
CEW4201	Advanced reinforced concrete	3	5	3	-	BLD	BSC001
CEW4202	Pre-stressed concrete	3	5	3	-	BLD	BSC001
CEW4203	Earthquake Engineering	3	5	3	-	BLD	BSC001
CEW4204	Timber structures	3	5	3	-	BLD	BSC001
CEW4205	Advanced Steel Structures	3	5	3	-	BLD	BSC001
CEW4206	Structural Systems	3	5	3	-	BLD	BSC001
CEW4207	Advanced Topics in Structural Engineering	3	5	3	-	BLD	BSC001
CEW4300	Traffic safety and management	3	5	3	-	BLD	BSC001
CEW4301	Highway Maintenance and Planning	3	5	3	-	BLD	BSC001
CEW4302	Transportation	3	5	3	-	BLD	BSC001
CEW4303	Railway Engineering	3	5	3	-	BLD	BSC001

CEW4304	Airport Engineering	3	5	3	-	BLD	BSC001
CEW4305	Advanced topics in Transportation engineering	3	5	3	-	BLD	BSC001
CEW4400	Dam Engineering	3	5	3	-	BLD	BSC001
CEW4401	Geographic Information Systems	3	5	2	-	BLD	BSC001
CEW4402	Soil Dynamics	3	5	3	-	BLD	BSC001
CEW4403	Soil and Rock Exploration	3	5	3	-	BLD	BSC001
CEW4404	Advanced Topics in Geotechnical Engineering	3	5	3	-	BLD	BSC001
CEW4500	Local practices in Building Construction	3	5	3	-	BLD	BSC001
CEW4501	Construction Machines	3	5	3	-	BLD	BSC001
CEW4502	Building Physics	3	5	3	-	BLD	BSC001
CEW4503	Advanced Topics in Construction	3	5	3	-	BLD	BSC001
CEW4504	Advanced topics in Project Management	3	5	3	-	BLD	BSC001
CEW4600	Food Systems Engineering	3	5	3	-	BLD	BSC001
CEW4601	Environmental Microbiology & Ecology	3	5	3	-	BLD	BSC001
CEW4602	Environmental Impact Assessment	3	5	3	-	BLD	BSC001
CEW4603	Systems Thinking & WEFE Modeling	3	5	3	-	BLD	BSC001
CEW4604	Renewable Energy Design (Solar, Wind, Bioenergy)	3	5	3	-	BLD	BSC001
CEW4605	Food Security & Agricultural Systems Management	3	5	3	-	BLD	BSC001
CEW4606	Integrated WEFE Systems Design	3	5	3	-	BLD	BSC001
CEW4607	Sustainability Concepts in Environmental Engineering	3	5	3	-	BLD	BSC001
CEW4608	Irrigation & Drainage Engineering	3	5	3	-	BLD	BSC001
CEW4609	Introduction to Biotechnology	3	5	3	-	BLD	BSC001
CEW4610	Environmental and Water Microbiology	3	5	3	-	BLD	BSC001
CEW4611	Disposal logistics	3	5	3	-	BLD	BSC001
CEW4612	Pollution Control of the Aquatic Environment	3	5	3	-	BLD	BSC001
CEW4613	Water Supply and Wastewater Collection	3	5	3	-	BLD	BSC001
CEW4614	International Environmental Law	3	5	3	-	BLD	BSC001
CEW4615	Process Engineering	3	5	3	-	BLD	BSC001
CEW4616	Process Operation	3	5	3	-	BLD	BSC001
CEW4617	Advanced Wastewater Treatment	3	5	3	-	BLD	BSC001
CEW4718	Air Pollution Control	2	5	2	-	BLD	BSC001
CEW2619	Air Pollution Control lab	1	5	0	3	BLD	BSC001
CEW4620	Water Resources Engineering	3	5	3	-	BLD	BSC001
CEW4621	Environmental unit process and operation	3	5	3	-	BLD	BSC001
CEW4622	Water Chemistry	2	5	2	3	BLD	BSC001
CEW4623	Environmental Impact Assessment	2	5	2	-	BLD	BSC001
CEW4624	Advanced topics in Environmental Engineering	3	5	3	-	BLD	BSC001
CEW4625	Drinking water abstraction and distribution	3	5	3	-	BLD	BSC001

CEW4626	Groundwater Modeling and Dynamics	3	5	3	-	BLD	BSC001
CEW4627	Heat and Mass Transfer	3	5	3	-	BLD	BSC001
CEW4628	Water and Wastewater Reuse	3	5	3	-	BLD	BSC001
CEW4629	Advanced topics in water and environmental engineering	3	5	3	-	BLD	BSC001
CEW4630	Advanced Topics in Water Engineering	3	5	3	-	BLD	BSC001
CEW4700	Independent Studies	3	5	3	-	BLD	BSC001
CEW4701	Special Topics I	1	2	1	-	BLD	BSC001
CEW4702	Special Topics II	2	4	2	-	BLD	BSC001
CEW4703	Special Topics III	3	5	3	-	BLD	BSC001
ARCH403	Special Topics in Architecture II	2	5	2	-	BLD	BSC001
ARCH426	Environmental Psychology and Sociology	3	5	3	-	BLD	BSC001
ARCH451	Design and Build	3	5	3	-	BLD	BSC001
ARC453	Building and Site Documentation	3	5	3	-	BLD	BSC001
ARCH457	Advanced Construction Systems	3	5	3	-	BLD	BSC001
ARCH554	Project Management and Site Organization II	3	5	3	-	BLD	BSC001
ARCH571	Architectural Environmental Systems	3	5	3	-	BLD	BSC001
ARCH262	Utility Planning and Design I	3	5	3	-	BLD	BSC001
ARCH362	Utility Planning and Design II	3	5	3	-	BLD	BSC001
ARCH361	Structural Systems II	3	5	3	-	BLD	BSC001
ENE534	Low Carbon Buildings	3	5	3	-	BLD	BSC001
ENE531	Environmental and Energy Engineering	3	5	3	-	BLD	BSC001
ENE528	Energy Storage	3	5	3	-	BLD	BSC001
ENE431	Energy Conversion	3	5	3	-	BLD	BSC001
Total		12	20				

I. Compulsory Courses Offered by Civil and Environmental Engineering Department

CEW2101 AI applications and Data Modeling for Civil Engineering	2 Cr Hr (3,0)	4 ECTS
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Introduction to the fundamentals of artificial intelligence applications and data-driven modeling techniques, Applying machine learning methods and AI tools in statistical analysis to solve engineering problems, and to perform Numerical Analysis. Process, visualize, and interpret large datasets, build predictive models, and apply AI tools to areas such as structural analysis, transportation systems, and environmental engineering. Integrating computational intelligence with traditional engineering approaches to support informed decision-making and innovative problem-solving in civil engineering practice.

Prerequisites: MATH101

CEW2102 Computer Aided Mathematics for CEW	2 Cr Hr (2,2)	4 ECTS
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Fundamentals of mathematical methods and their applications in civil and environmental engineering using computer-based tools. The course covers numerical methods, mathematical modeling, data analysis, and the solution of engineering problems involving algebra, calculus, differential equations, and linear algebra. Emphasis is placed on the practical use of computational tools to analyze, visualize, and solve engineering problems efficiently.

Corequisites: CEW2101

CEW2103 General Chemistry 2	3 Cr Hr (3,0)	5 ECTS
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Structure; Bonding and Molecular Properties of organic Compounds; Alkanes and Cycloalkanes; Stereochemistry of Alkanes and Cycloalkanes; Alkenes and alkynes; Stereochemistry; Alkyl Halides and their Reactions; Aromatic Compounds and their Reactions. Alcohols; ethers; thiols; Aldehydes and ketones; Carboxylic acids and derivatives; Amines.

Prerequisites: CHEM103

CEW2104 Engineering Professional Development	3 Cr Hr (3,0)	5 ECTS
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Principles of engineering professional development, including engineering ethics, English technical writing, effective communication, teamwork, and leadership. Development of professional competencies through career planning, continuous learning, and problem-solving. Emphasis on the use of digital tools and modern engineering practices to enhance professional performance, productivity, and career readiness.

Prerequisites: ENGL0099

CEW2201 Building Materials	3 Cr Hr (2,3)	5 ECTS
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Cement (types; manufacture; properties and hydration); aggregates; mixing water; fresh concrete properties; hardened concrete (strength; strength development; shrinkage; creep; durability); handling and placing of concrete; concrete mix design by ACI method; bricks and bricks works. This course is integrated with the lab to cover the practical part including Introduction to testing & specifications; concrete and mortar tests; aggregate testing; fresh and hardened concrete testing; non-destructive tests; design & testing of concrete mixes; tension test of steel bars, brick testing.

Prerequisites: ---

CEW3201 Analysis of Structures and Modeling	3 Cr Hr (3,0)	5 ECTS
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Structural elements, loads calculations and transfer, Structural systems, Analysis of statically determined structures by manual calculation, trusses, beams and frames, NFD, SFD, BMD., Live load cases and bending moment envelopes, Influence lines, Displacements. Analysis of statically indeterminate structures; Computer modeling of 2D structures, Computer modelling of 3D structures. Deflection and lateral displacements.

Prerequisites: MECH2102

CEW3202 Dynamics & Seismic Analysis of Structures	3 Cr Hr (3,0)	5 ECTS
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Kinetics of Particles and Rigid Bodies, Linear and Nonlinear dynamic analysis (SDOF), Principles of Vibrations of structures, Seismic Loads and Wind Loads on Structures, Equivalent Lateral Force Analysis, Computer modeling of wind loads and seismic loads on structure and Codes provisions, Modal Response Spectra Analysis, and Time history analysis.

Prerequisites: CEW3201

CEW5201 Smart Design of Structures 1	3 Cr Hr (3,0)	5 ECTS
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Fundamental properties of concrete and steel; ultimate strength design; analysis and design of reinforced concrete beams for flexure and shear; design of one-way solid and ribbed slabs; and design of RC columns. Application of computer-aided analysis and design software integrated with AI and optimization techniques to develop and optimize structural elements through the selection of appropriate cross-sectional dimensions, reinforcement quantities, and material usage, while achieving economical, safe, and material-efficient designs that satisfy strength, serviceability, and relevant code requirements.

Prerequisites: CEW3201& CEW2201

CEW5202 Smart Design of Structures 2	3 Cr Hr (3,0)	5 ECTS
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Analysis, design, and modeling of two-way solid and ribbed slabs, foundations, and retaining walls. Analysis and design of structural steel elements, including tension members, compression members, beams, beam-columns, base plates, and steel joints and connections. Application of computer-aided structural modeling and design software integrated with AI optimization techniques to optimize reinforced concrete and steel structural systems through the selection of appropriate structural configurations, member dimensions, material properties, and connection details.

Prerequisites: CEW5201

CEW5501 Building Information Modeling & Sustainable Construction	3 Cr Hr (3,0)	5 ECTS
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Introduction to Autodesk Revit in a lab-based format, creation of building information models, floor plans, and essential architectural elements such as walls, floors, ceilings, roofs, space frames, curtain walls, stairs, and railings, developing sections, elevations, annotations, schedules, legends, and high-quality renderings. Practical skills in quantity surveying, clash detection, troubleshooting, and design improvisation. Modern construction technologies and systems in civil engineering, including layouts, fabrication, assembly, and installation of structural units, how buildings progress from planning to roof completion, sustainable construction practices, such as energy-efficient design, material optimization, waste reduction, life-cycle assessment, and green building certifications.

Prerequisites: CEW3201& CEW3302

CEW5502 Engineering Economics, Management, and Digital Applications	3 Cr Hr (3,0)	5 ECTS
Principles of engineering economics, project management, and financial decision-making in engineering projects. Cost estimation, economic analysis, budgeting, resource allocation, and investment appraisal. Fundamentals of engineering management, including project planning, scheduling, risk management, and quality control. Application of digital tools and software for engineering calculations, project management, data analysis, and decision support, with emphasis on improving efficiency, sustainability, and productivity in engineering practice. <i>Prerequisites: CEW3603</i>		
CEW3302 Traffic Engineering and Smart Mobility Analytics	3 Cr Hr (3,0)	5 ECTS
This course covers the fundamental principles of traffic flow theory, capacity analysis, and traffic control devices, integrated with modern smart mobility concepts. Topics include traffic data collection methods using advanced sensors, intersection signal design, and level of service analysis. The "Smart Mobility" component introduces Intelligent Transportation Systems (ITS), big data analytics in transportation, and the modeling of traffic behavior using simulation software. Students will learn to analyze urban mobility patterns to optimize traffic flow and reduce congestion. <i>Prerequisites: CEW3301</i>		
CEW5301 Pavement Systems and Design	3 Cr Hr (3,0)	5 ECTS
This course focuses on the structural design, performance, and management of flexible and rigid highway pavements. It covers the rheology of bituminous materials, Superpave mix design, and stress analysis in pavement layers. The course emphasizes modern maintenance and rehabilitation techniques, including Pavement Management Systems (PMS). Students will also explore sustainable pavement technologies, such as recycled materials and permeable pavements, aligned with the WEF program's environmental goals <i>Prerequisites: CEW3302</i>		
CEW3301 Surveying and Remote Sensing	3 Cr Hr (3,0)	5 ECTS
This course covers the fundamental principles of plane surveying and the application of remote sensing technologies in civil engineering. Topics include error theory, distance measurement, differential leveling, and traverse computations using modern Total Stations and Global Navigation Satellite Systems (GNSS). The remote sensing component introduces the acquisition, processing, and analysis of spatial data from satellite imagery, aerial photography, and LiDAR, emphasizing their integration with AI and digital terrain modeling. The laboratory component provides hands-on field experience in topographic mapping and practical training in processing geospatial data for smart infrastructure planning. <i>Prerequisites: CEW2101</i>		
CEW2401 Engineering Geology	3 Cr Hr (2,3)	5 ECTS
This course examines the origin, classification, and engineering properties of earth materials (minerals and rocks), emphasizing their role as construction resources. The course analyzes dynamic Earth processes (endogenic and exogenic), including weathering, soil formation, and groundwater geology. Special focus is placed on assessing geological hazards (such as landslides and earthquakes) to ensure infrastructure resilience and introducing geological mapping and site investigation data as a foundation for smart geotechnical monitoring. <i>Prerequisites: ---</i>		

CEW3401 Smart Geotechnical Engineering and Lab	3 Cr Hr (3,0)	6 ECTS
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An integrated theoretical and practical course covering advanced soil mechanics and geotechnical testing. Topics include soil classification, permeability, seepage, consolidation theory, and shear strength of soil. The laboratory component involves standard testing (direct shear, unconfined compression, consolidation). The "Smart" aspect introduces geotechnical monitoring and instrumentation, using sensors to measure soil behavior, pore pressure, and ground movement in real-time, preparing students for data-driven foundation engineering.

Prerequisites: CEW2401 & MECH2102

CEW5401 Foundation Engineering	3 Cr Hr (3,0)	5 ECTS
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Apply the principles of geology and soil mechanics to the design and analysis of foundations of various structures, such as columns and walls of buildings, bridges, retaining structures, and others. Design of shallow foundations and axially loaded pile foundations. Lateral earth pressure theories and the design of various retaining structures. Selection of proper foundations or characteristics of foundations for different soils. Theoretical and empirical design methods for stability and settlement.

Prerequisites: CEW3401

CEW2601 Thermal Fluids Science	3 Cr Hr (3,0)	5 ECTS
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This course provides an introduction to the core principles of thermodynamics, fluid mechanics, and heat transfer. Students learn fundamental thermodynamic concepts, the behavior of pure substances, the ideal-gas model, and the application of the first and second laws to common engineering devices such as turbines, compressors, valves, and heat exchangers. The fluid mechanics section covers fluid properties, fluid statics, Bernoulli and energy equations, momentum analysis, and pipe flow under laminar and turbulent conditions. The heat transfer portion introduces conduction, convection, and radiation, with emphasis on steady-state conduction and basic convection mechanisms. The course builds a foundational understanding of thermal-fluid processes essential for engineering practice.

Prerequisites: PHYS103

CEW2603 Introduction to Renewable Energy	3 Cr Hr (3,0)	5 ECTS
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This course provides a comprehensive overview of renewable energy systems, covering a wide range of topics crucial for understanding renewable energy production, conversion, site assessment, and opportunities. This course offers an in-depth exploration of renewable energy systems, focusing on the principles and applications of various energy sources, efficient use, and technologies. Students will gain a thorough understanding of: -Energy Units and Types: Fundamental concepts and sources classifications. - Energy Conversion and Efficiency: Methods and metrics for optimizing energy use. -Environmental Impact: Assessing the ecological effects of energy production. – solar energy systems, wind energy systems, hydropower, geothermal, tidal, and possible energy Storage Technologies. Through practical examples and detailed calculations, this course equips students with the knowledge needed to analyze and improve energy systems.

Prerequisites: CEW2601

CEW3601 Wastewater Treatment Engineering	3 Cr Hr (3,0)	5 ECTS
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This course provides a comprehensive overview of wastewater characteristics and the design of physical, chemical, and biological treatment systems. Topics include preliminary treatment, primary sedimentation, activated sludge processes, biofilm systems, and disinfection. The accompanying laboratory component focuses on water quality analysis (BOD, COD, TSS, Nitrogen, Phosphorus). Emphasis is placed on viewing wastewater as a resource, introducing concepts of water reuse and reclamation suitable for the WEFE nexus.

Prerequisites: CEW2602

CEW3602 Introduction to the WEFE Nexus	1 Cr Hr (1,0)	2 ECTS
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This course introduces the Water–Energy–Food–Ecosystems (WEFE) Nexus as an integrated framework for understanding resource interdependencies. Students will explore the fundamental characteristics of each sector, examine synergies and trade-offs, and assess how nexus thinking supports sustainable development, climate resilience, and resource security. The course will cover the conceptualization of the WEFE nexus, the sectoral interdependencies, the role of the eco-systems, and synergies and tradeoffs of the different sectors, and the policy and governance.

Prerequisites: CEW2603

CEW5601 Climate Change Adaptation & Ecosystem Services	2 Cr Hr (3,0)	4 ECTS
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This course examines the impacts of climate change on civil infrastructure and natural ecosystems. It explores engineering strategies for adaptation and resilience, such as flood risk management, drought mitigation, and resilient urban design. The concept of "Ecosystem Services" is quantified, teaching students how to value and integrate natural infrastructure (e.g., wetlands for water purification) into engineering projects to mitigate climate risks and enhance biodiversity. The course introduces the climate science to engineers, it discusses the risks of extreme weather on water supply systems, introduces adaptation strategies, and introduces nature based solutions to mitigate climate change risks.

Prerequisites: CEW3601

CEW5602 WEFE Nexus Modeling and Decision Tools	3 Cr Hr (3,0)	5 ECTS
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This course provides an introduction to quantitative modeling approaches used to analyze and support decision-making within the WEFE Nexus. Students will learn how to integrate sector-specific datasets, apply scenario-based modeling, and utilize analytical tools for evaluating interactions across water, energy, food, and ecosystem systems. The course emphasizes open-source software and real-time monitoring. It introduces systems thinking and quantitative cross sectoral analysis, surface and water hydrological modeling, smart monitoring and IoT integration, scenario development, and decision support systems.

Prerequisites: CEW2603

CEW2602 Hydraulics and Hydrology	4 Cr Hr (3,3)	6 ECTS
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This course integrates the fundamental principles of engineering hydrology and applied hydraulics within the context of smart water management and the WEF nexus. The course covers the hydrologic cycle, precipitation analysis, and runoff modeling, alongside the mechanics of flow in closed conduits and open channels, including energy principles, friction losses, and pump systems. Emphasis is placed on modern applications such as flood routing, real-time flow monitoring, and leakage detection using smart sensors and simulation software. The accompanying laboratory component reinforces these concepts through practical experiments on flow measurement, head loss analysis, and hydraulic jumps, preparing students to design efficient and sustainable water infrastructure.

Prerequisites: CEW2601

CEW4801 Field training in Jordan	0 Cr Hr (0,0)	6 ECTS
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In the second semester of the fourth academic year of the program, the student is expected to find a place in German industry in order to gain industrial experience. This can be done by preparing a good resume and by contacting and applying to as many German civil or water industrial companies as possible.

Prerequisites: Passing 90 Cr Hrs

CEW4802 International internship in Germany	12 Cr Hr (0,0)	30 ECTS
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In the second semester of the fourth academic year of the program, the student is expected to find a place in German industry in order to gain industrial experience. This can be done by preparing a good resume and by contacting and applying to as many German civil or water industrial companies as possible.

Prerequisites: Passing 115 Cr Hrs

CEW5901 Graduation Project 1	1 Cr Hr (3,0)	4 ECTS
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Students will pick a particular problem in civil and environmental engineering, and carry out a literature survey of the problem, and then suggest an alternate solution to the problem. They must show a good ability in effectively applying the fundamentals of mathematics, physics, chemistry, engineering, etc...; in finding the 21 alternate solutions. This course should help the students in assessing their strengths and weaknesses in applying fundamental principles to real-life problems.

Prerequisites: Passing 120 CHrs

CEW5902 Graduation Project 2	2 Cr Hr (2,0)	5 ECTS
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Students will continue with the problem in civil and environmental engineering in CEE591; carry out an extensive study, and suggest alternate solutions to the problem. They must show ability in effectively applying the fundamentals of mathematics, physics, chemistry, engineering, etc., in finding alternative solutions.

Prerequisites: CEW5901

CEW3603 Sustainable Engineering and Entrepreneurship**3 Cr Hr (3,0)****5 ECTS**

Principles of sustainable engineering and green innovation, environmental challenges, and the development of sustainable products and services. Identification of entrepreneurial opportunities in renewable energy, resource efficiency, waste management, and green technologies. Business model development, feasibility studies, financial planning, and marketing strategies for sustainable engineering ventures. Emphasis on innovation, creativity, and the application of engineering knowledge to develop environmentally responsible and economically viable solutions.

Prerequisites: CEW3602