



الجامعة الألمانية الأردنية
German Jordanian University

German Jordanian University

**School of Architecture and Built
Environment**

**Department of Architecture and Interior
Architecture**

Master of Science Program in

Sustainable Buildings

Thesis Track

Study Plan 2023

I. Program Objectives

- a. incorporates multi-dimensional perspectives using problem-solving practical approaches
- b. to achieve integrated sustainable building design, construction, evaluation and operation
- c. Graduates are prepared to contribute to the contemporary built environment at the local, regional, and international arenas with their hands-on up-to-date theories and practices

II. Learning Outcomes

a. Key knowledge

- a. **Program graduates will be able to understand, interpret, explain, analyze, and assess various sustainable concepts and methods.**

Assessments

Student achievement of this learning outcome is assessed:

[Directly] by sample M.Sc. Thesis that reflects the students' overall work in the program and student accumulative courses scores.

[Indirectly] by senior surveys and by program review data and job placement rates.

b. Skills

- a. **Program graduates will be able to understand, interpret, explain, analyze, and assess various sustainable concepts and methods.**
- b. **Program graduates will be able to undertake and investigate various research areas related to sustainable buildings.**

Assessments

Student achievement of this learning outcome is assessed:

[Directly] by reviewing samples of student work (research papers and analysis projects).

[Indirectly] by employer surveys.

c. Values

- a. **Program graduates will be able to assess their own strengths and weaknesses and adjust future performance in light of their self-assessments.**

Assessments

Student achievement of this learning outcome is assessed:

[Directly] by instructor evaluations.

[Indirectly] by student self-assessments and acceptance into leading Ph. D. programs.

Course Delivery Methods

Courses are in one of the following three methods:

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

Courses using this method are delivered by faculty in person in regularly scheduled class sessions physically on campus.

- **Blended (BLD) Method**

Courses are delivered in a hybrid mode of physical face-to-face class sessions and asynchronous material including online instructional videos, presentations, projects, and similar learning activities.

- **Online (OL) Method**

Courses are delivered exclusively online. This method consists of a hybrid of synchronous regularly scheduled class sessions delivered via the Internet, and asynchronous material including online instructional videos, presentations, projects, and similar learning activities. Virtual classrooms utilizing different online platforms are used. No physical face-to-face meetings are required.

III. Admission Requirements

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

- a. All students having a BSc degree in any engineering discipline
- b. Must hold a Bachelor's degree with a minimum average of "good" or equivalent, from a recognized university. Bachelor students with a "satisfactory" average, or equivalent, may be accepted only if they abide to regulations of the Ministry of Higher Education and Scientific Research.
- c. Bachelor's student studies and attendance must have been on a regular basis.
- d. Student must show a documented proof indicating he/she successfully passed the Foreign Languages Proficiency Test (English language) (TOEFL, IELTS) in accordance with the decisions of the Higher Education Council.

IV. Degree Requirements (Credit hours)

Degree requirements _____

Classification	Credit Hours
Compulsory courses	21
Elective courses	3
Elective Project courses	3
Thesis	9
Total	36

V. Curriculum (Credit hours)

1. Compulsory Requirements: (21 credit hours)

Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
				Lect	Lab		
GB760	Sustainable Building Systems	3				BLD	-
GB761	Introduction to Sustainable Construction Methods	3				BLD	-
GB762	Sustainable Building Assessment	3				F2F	GB760
GB763	Sustainable Building Simulation	3				BLD	GB761
GB764	Sustainable Urban Concepts	3				F2F	-
GB780	Project Management and Building Laws	3		3	0	F2F	-
SABE724	Research Methods	3		3	-	F2F	-
Total		21		00	00		

2. Elective Courses: (03 credit hours out of the following)

Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
				Lect	Lab		
GB750	Glass Facades	3		3	-	F2F	-
GB765	Strategy for sustainable construction	3		3	-	F2F	-
GB781	Construction site management	3		3	-	F2F	-
ERE 733	Energy Efficiency	3		3	-	F2F	-
ERE 734	Techno Economic Feasibility	3		3	-	F2F	-
ERE743	Environmental Biotechnology and Bioenergy	3		3	-	F2F	-
ERE 744	Climate Change and Predictability	3		3	-	F2F	-
ERE752	Water, Energy, and Environment Management	3		3	-	F2F	-
ERE771	Energy, Environmental and Water Laws and Policies	3		3	-	F2F	-
SP 742	Land-Use Planning and Legislations	3		3	-	F2F	-
SP 770	Sustainable Planning I	3		3	-	BLD	-
SP 785	Project Management and Implementation	3		3	-	F2F	GB761 or SP780 or AC748
Minimum required		3		3	-		

3. Project Elective Requirements: (03 credit hours)

Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
				Lect	Lab		
GB710	Special Projects in Sustainable Buildings	3		3	-	F2F	GB761
GB711	Special Projects in Implementation Management	3		3	-	F2F	GB761
Minimum required		3		3	-		

4. Thesis: (09 credit hours)

Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
				Lect	Lab		
GB799 A	Master Thesis/ Sustainable Buildings	0		-	-	F2F	SABE724
GB799 B	Master Thesis/ Sustainable Buildings	3		-	-	OL	SABE724
GB799 C	Master Thesis/ Sustainable Buildings	6		-	-	F2F	SABE724
GB799 D	Master Thesis/ Sustainable Buildings	9		-	-	F2F	SABE724
Minimum required		9		0	0		

VI. Study Plan Guide

First Year							
First Semester							
Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
				Lect	Lab		
GB760	Sustainable Building Systems	3				BLD	-
GB761	Introduction to Sustainable Construction Methods	3				BLD	-
SABE724	Research Methods	3				F2F	-
Total		9	0	0	0		

First Year							
Second Semester							
Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
				Lect	Lab		
GB762	Sustainable Building Assessment	3				F2F	GB760
GB763	Sustainable Building Simulation	3				F2F	GB761
-	Elective Requirement (1)	3	-	-	-		-
Total		9	0	0	0		

Second Year							
First Semester							
Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
				Lect	Lab		
GB764	Sustainable Urban Concepts	3		3	-	F2F	-
GB710 or GB711	Elective Project Requirement	3		3	-	F2F	GB761
GB780	Project Management and Building Laws	3		3	-	F2F	-
GB799 B	Master Thesis / Sustainable Buildings	3		3	-	BLD	SABE724
Total		12	0	0	0		

Second Year							
Second Semester							
Course ID	Course Name	Credit Hours	ECTS	Contact Hours		Type	Prerequisites / Corequisites
				Lect	Lab		
GB799 C	Master Thesis / Sustainable Buildings	6		6	-	F2F	SABE724
Total		6	0	0	0		

VII. Course Descriptions

1. Compulsory Courses

GB760 Sustainable Building Systems	03 Cr Hr	00 ECTS
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Planning guidelines for sustainable constructing, Requirements (norms, standards) for materials and technical construction to achieve comfort, quality of space and ecological sustainable construction. Use of Energy saving assessment, Criteria and policy for Sustainable building certificate.

Prerequisites: -

Corequisites: -

GB761 Introduction to Sustainable Construction Methods	03 Cr Hr	00 ECTS
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The required competences are all matters concerning sustainable construction, planning, operating and maintaining buildings. Sustainable building practices revolve around a few basics, whole life-cycle consideration in building conception, planning for maximum efficiency, ecological sustainable construction, maximum sustainability in materials and processes, health and cost effectiveness of building over the long-term-construction.

Prerequisites: -

Corequisites: -

GB762 Sustainable Buildings Assessment	03 Cr Hr	00 ECTS
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Basics of sustainable construction, German Sustainable building certificate of the DGNB (German Sustainable Building Council), Life Cycle Assessment and Life Cycle Costs (evaluation of ecological footprint), Basics of sustainable planning of buildings, Planning and execution phases of projects, Scheduling, Cooperating/working partnership with architects.

Prerequisites: GB760

Corequisites: -

GB763 Sustainable Building Simulation	03 Cr Hr	00 ECTS
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Basics of modeling calculation, process parameter of model calculation, energy systems engineering (heat, cold, air), computer exercises with current calculation programs for lighting design, heat retention, types and functions of control elements, design of building's envelope related to energy performances

Prerequisites: GB761

Corequisites: -

GB764 Sustainable Urban Concepts	03 Cr Hr	00 ECTS
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Studies of urban space, streets, paths and squares as public space by examining sustainability; typologies of building structures, spatial structures and spatial sequences, quality of spaces for users, features and design, weaknesses and strengths, development of a specific design respecting sustainability. Aspects of urban design concepts, e.g. bus priority design features, pedestrian oriented design, cyclist amenity options etc.

Prerequisites: -

Corequisites: -

SABE 724 Research Methods	03 Cr Hr	00 ECTS
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This course provides students with theoretical and practical knowledge needed to write and present technical research papers. The course covers research norms, data collection tools and techniques, methods of evaluating information, data analysis techniques and data interpretation, quantitative (experimental, quasi-experimental, and survey) and qualitative studies (case studies, comparative analysis, field reconnaissance surveys, participant observation, and archival). The review includes all methods of observation and data collection with focus on measurements, reliability, validity, data analysis, interpretation, inferences, reporting, and research ethics. It also provides students with theoretical and practical knowledge needed to write thesis proposals and final Master's Thesis. The course covers preparation for thesis writing, thesis management, proposal rewriting, conducting oral and visual presentations, and teaching and training didactics..

Prerequisites: -
Corequisites: -

GB780 Project Management & Building Laws	03 Cr Hr	00 ECTS
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Management of construction sites in Germany, Basics of Construction Management. Contracting procedures for construction works (VOB/B) and the Official Scale of Fees for Services by Architects and Engineers (HOAI), Construction management, Scheduling. Basics of Quality control, time management and cost estimates, Construction manager's liability. Insurances procedures and needs, Safety measures and planning document

Prerequisites: -
Corequisites: -

2. Elective Courses

GB750 Glass Facades	03 Cr Hr	00 ECTS
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Construction specifications and applied building physical and statistical calculation methods of Cold façade, warm façade, cold/warm façade and membrane façade. Mullion-transom system and construction methods derived from these; unitized-box, modular system façade, double molding, pit and corridor fronts, Surface structure and curtain wall – thin-walled façade panel, thin-walled front elements and membranes, Glass construction, Material combination for constructions with load bearing function – sandwich-plates – prefabricated steel elements- and alum sandwich elements, Laboratory components: mobile façade tester, front construction laboratory.

Prerequisites: -
Corequisites: -

GB765 Strategy for sustainable construction	03 Cr Hr	00 ECTS
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Reprocessing the basics of stationary heat conduction and humidity, European Approaches to detect methods of saving energy, Detection methods for current standardization, Computer Exercises with transient calculation programs for heat and humidity, Computer Exercises with current programs for lighting design, Computer Exercises with current programs for the heat retention, Basics of modeling calculation, Process parameter of the modeling calculation. Indoors/outdoors climate, Energetic systems engineering (heating, cooling, air conditioning, ventilation), Types and functions of control elements/constructions, Design of façade as related to holistic properties of energy, Computer Exercises with modeling programs

Prerequisites: -
Corequisites: -

GB781 Construction site management	03 Cr Hr	00 ECTS
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Planning and work preparation, Scheduling, time management and planning, Construction process, Audit, Invoice and appraisal of performances, Claims, Construction documents and appropriate documentation, Termination of construction and final achievement, software for project management.

Prerequisites: -
Corequisites: -

ERE 733 Energy Efficiency	03 Cr Hr	00 ECTS
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Techniques and approaches adapted to improve the efficiency of energy generation, utilization, conversion, transport, storage and management. Energy audits. Energy conservation opportunities for efficiency improvements in different sectors: industrial, commercial, transportation and domestic. Economic regulatory and infrastructure issues affecting the implementation of energy efficiency measures as well as their potential for solving energy and environmental problems. Energy flow simulations in buildings. Best practices in building design. This course includes students performing real energy audits.

Prerequisites: -
Corequisites: -

ERE 734 Techno Economic Feasibility	03 Cr Hr	00 ECTS
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Technological, cost, and environmental fundamentals of emerging renewable sources of energy and environmental systems; including solar, wind, biomass, geothermal, hydropower and fuel cell, water supply assessment and cost recovery options, water use efficiency measures, Pollution and remediation and treatment options assessments. The economics of source reduction, recycling, reuse, and recovery of wastes. Renewable

energy sources commercialization and measurement. Economic and technical performance indicators of renewable energy and energy efficiency systems and environmental systems; LCOE and payback periods. This course include using software and projects to carry out real techno economic studies for real systems..

Prerequisites: -

Corequisites: -

ERE743 Environmental Biotechnology and Bioenergy **03 Cr Hr** **00 ECTS**

Basic concepts of biotechnology: Biomass characterization, Biomass growth and kinetics. Bioconversion systems: types of biomass, which are currently considered for conversion into bio-energy conversion pathways available to turn biomass into bio-products. Identify energy potentials of biomass and biogas. Bio-fuels and Combustions Engines.

Prerequisites: -

Corequisites: -

ERE 744 Climate Change and Predictability **03 Cr Hr** **00 ECTS**

Fundamental aspects of the predictability of weather and climate. Basic theory of the divergence of trajectories in phase space and the periodic and chaotic properties of the flow are illustrated using simple nonlinear dynamical models. The dynamics of error growth, local and global predictability, and predictability of flows with many scales will be discussed. The predictability and error growth in large weather forecasting systems, predictability in mid-latitudes and tropics, and targeted observations will be studied. Predictability of time-mean quantities in large climate models, the role of ocean and land boundary forcing, and predictability of coupled models.

Prerequisites: -

Corequisites: -

ERE752 Water, Energy, and Environment Management **03 Cr Hr** **00 ECTS**

This course addresses major topics such as water quantity, water quality, , and energy. It also addresses topics related to Middle East water/energy resources situation and management. Socioeconomic factors. Recycling and conservation of water. Aquifers and its over-pumping. Discharge of human and industrial wastewater. National and international institutions. Militarization of water. Politics and research as part of the solution. Integrated water resource management. Principles and practice of water resources planning and management. Protocols employed at local, state, regional and international levels. Plan formulation, evaluation, and implementation. Stakeholder involvement in planning processes. Analytical tools. Case studies with emphasis on the MENA region

Prerequisites: -

Corequisites: -

SP 742 Land-Use Planning and Legislations **03 Cr Hr** **00 ECTS**

The course concerns land-use strategies and policies and planning legislations. It presents principles, requirements and strategies for technical infrastructure networks (transport, water supply and drainage, energy supply and communication). The course aims at acquainting students with substantial knowledge and skills in the legal and organizational issues of overall planning at micro and macro levels. It also introduces the sustainable necessities of land use plans and methods of their transformation into action plans.

Prerequisites: -

Corequisites: -

SP 770 Sustainable Planning I **03 Cr Hr** **00 ECTS**

The course intends to create greater awareness of problems and potentials related to use, conservation and management of natural resources. Emphases are on the concept of resource efficient planning, and the interdependencies between environmental factors and human activities as basic requirements for planners. The course includes the following topics: introduction to the basics of landscape ecology, ecosystems and interaction between man and nature, international environmental conventions, land use zoning, classification and evaluation, environmental economics, natural resources management and conservation, and implementation of environmental projects.

Prerequisites: -

Corequisites: -

SP 785 Project Management and Implementation	03 Cr Hr	00 ECTS
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The course deals with institutional and practical issues of designing and implementing development projects in the region. It covers theories and knowledge about systems management of development plans at the local and regional levels. It also covers the issues of administrative and political structures and reforms associated with decentralization, legislations, collaboration and other governance issues.

Prerequisites: GB761, SP780, AC748

Corequisites: -

ERE771 Energy, Environmental and Water Laws and Policies	03 Cr Hr	00 ECTS
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An introduction into the environmental and energy justice system. An Introduction to environmental and energy values and policies. Economics and the environment. Overview of the structure of the environmental laws. Regulatory legislation and the regulatory process. Air pollution problems and control. Contemporary climate litigation. Water pollution control. Statutory Authorities. Regulation from point sources. Effluent limitations. Water quality based controls. Environmental impact assessment. Environmental enforcement. Citizens' law suits. Global climate change. Environmental and climate justice.

Prerequisites: -

Corequisites: -

3. Project Elective Requirements

GB710 Special Projects in Sustainable Buildings	03 Cr Hr	00 ECTS
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This course allows specialized or in-depth field work of a subject supplementing in Sustainable Buildings. Student interest and instructor expertise help determine the topic, to be announced in the classroom.

Prerequisites: GB761

Corequisites: -

GB711 Special Projects in Implementation Management	03 Cr Hr	00 ECTS
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This course allows specialized or in-depth field work of a subject supplementing implementation management. Student interest and instructor expertise help determine the topic, to be announced in the classroom.

Prerequisites: GB761

Corequisites: -

4. Thesis Requirements

GB799 A Master Thesis/ Sustainable Buildings	00 Cr Hr	00 ECTS
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This course involves extensive research in Sustainable Buildings. The Master's Thesis is based on field research and demonstrates student's background knowledge. A defense will be set to evaluate student's capabilities of carrying out research, with a focus on the analysis and interpretation of skills gained.

Prerequisites: SABE724

Corequisites: -

GB799 B Master Thesis/ Sustainable Buildings	03 Cr Hr	00 ECTS
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This course involves extensive research in Sustainable Buildings. The Master's Thesis is based on field research and demonstrates student's background knowledge. A defense will be set to evaluate student's capabilities of carrying out research, with a focus on the analysis and interpretation of skills gained.

Prerequisites: SABE724

Corequisites: -

GB799 C Master Thesis/ Sustainable Buildings	06 Cr Hr	00 ECTS
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This course involves extensive research in Sustainable Buildings. The Master's Thesis is based on field research and demonstrates student's background knowledge. A defense will be set to evaluate student's capabilities of carrying out research, with a focus on the analysis and interpretation of skills gained.

Prerequisites: SABE724

Corequisites: -

GB799 D Master Thesis/ Sustainable Buildings	09 Cr Hr	00 ECTS
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. This course involves extensive research in Sustainable Buildings. The Master's Thesis is based on field research and demonstrates student's background knowledge. A defense will be set to evaluate student's capabilities of carrying out research, with a focus on the analysis and interpretation of skills gained.

Prerequisites: SABE724

Corequisites: -