German Jordanian University

School of Architecture and Built Environment

Department of Architecture and

Interior Architecture

Study Plan

Masters of Science Program in

Sustainable Buildings

Non-Thesis Track

2022-2023

Masters of Science Program in Sustainable Buildings

Program Objectives

This one-of-a-kind graduate program in Sustainable Buildings as an interdisciplinary field of study incorporates multi-dimensional perspectives using problem-solving practical approaches to achieve integrated sustainable building design, construction, evaluation and operation. 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.

The M. Sc. Program in Sustainable Buildings aims at:

1. Preparing qualified and efficient practitioners and designers who are acquainted with the local needs of the Jordanian and international markets.
2. Graduating engineers who are capable of facing development challenges at local and international levels using integrated sustainable strategies qualitatively and quantitatively.
3. Acquainting graduates with realistic, yet creative, problem solving methods in implementation management at local and international levels.
4. Contribution in the provision of sanitary, sustainable and environment-friendly buildings that are high in efficiency and reasonable in cost.
5. Implementation of environmentally-friendly techniques in construction works.
6. Proficiency in handling the increasing demand for water, as well as the challenges of energy conservation, resource depletion, climate change and environmental sustainability in Jordan.
7. Remaining up to date with the scientific and technical developments in the field of sustainable building locally, regionally and internationally.

8. Working in congruence with the National strategies for energy and water sectors.
9. Implementation of concepts of sustainability in all relevant fields and provision of a healthy environment that facilitates the comfort of inhabitants and improves the productivity of workers.

Learning Outcomes

1. **Key knowledge**

   Program graduates will be able to design, evaluate, and implement sustainable construction projects.

   Assessments

   Student achievement of this learning outcome is assessed:

   1) [Directly] by sample M.Sc. Thesis that reflects the students' overall work in the program and student accumulative courses scores.
   2) [Indirectly] by senior surveys and by program review data and job placement rates.

2. **Skills**

   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:

   1) [Directly] by reviewing samples of student work (research papers and analysis projects).
   2) [Indirectly] by employer surveys.

   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:

1) [Directly] by reviewing samples of student work (working and research papers).
2) [Indirectly] by employer surveys.

3.Values

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:

1) [Directly] by instructor evaluations.
2) [Indirectly] by student self-assessments and acceptance into leading Ph. D. programs.

Who can attend the program?

All students having a BSc degree in any engineering discipline are eligible to apply to this master program.

Curriculum for Masters of Science Degree in sustainable Buildings

Classification	Credit Hours
	Total
Compulsory Requirements	**30**
Elective Requirements	**3**
Elective Project Requirement	**3**
Comprehensive Exam	**0**
Total	**36**

1) Compulsory Requirements (30 Credit Hours):

Course No.	Course Title	Cr. hrs.	Lecture	Studio	Prerequisite	F2F/ Blended/ Online
GB760	Sustainable Building Systems	3			-	Blended
GB761	Introduction to Sustainable Construction Methods	3			-	F2F
GB762	Sustainable Building Assessment	3			GB760	F2F
GB763	Sustainable Building Simulation	3			GB761	F2F
GB764	Sustainable Urban Concepts	3			-	F2F
GB780	Project Management and Building Laws	3	3	0	-	F2F
SABE724	Research Methods	3	3	-	-	F2F
SP770	Sustainable Planning, I	3	3	-	-	F2F
SP 785	Project Management and Implementation	3	3	-	GB761 or SP780 or AC748	F2F
SABE725	Professional Practice Skills	3	-	-	SABE 724	F2F

GB799E	Comprehensive Exam	0	0	0	-	F2F
	Total	**30**				

2) Elective Requirements (3 Credit Hours) to be chosen from the following:

Course No.	Course Title	Cr. hrs.	Lecture	Studio	Prerequisite	F2F/ Blended/ Online
GB750	Glass Facades glass	3	3	-	-	Online
GB765	Strategy for sustainable construction	3	3	-	-	Blended
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
SP742	Land-Use Planning and Legislations	3	3	-	-	F2F
	Total Taken	**3**				

3) Project Elective Requirements (3 Credit Hours) to be chosen from the following:

Course No.	Course Title	Cr. hrs.	Lecture	Studio	Prerequisite	F2F/ Blended/ Online
GB710	Special Projects in Sustainable Buildings	3	3	-	GB761	F2F
GB711	Special Projects in Implementation Management	3	3	-	GB761	F2F
	Total Taken	**3**				

Course Code:

The digits have the following representation:

- The left digit represents the course level.
- The middle digit represents the specialized field of knowledge of the course as follows:
    - 0. Special Topics
    - 1. Projects.
    - 2. Research Methodology
    - 4. Built Environment
    - 5. Technology
    - 6. Sustainability
    - 7. Environment
    - 8. Implementation Management
    - 9. Masters Thesis
- The right digit represents the sequence of the course within the field.

Study Plan Guide for the Masters of Science Degree in Sustainable Buildings (Non-Thesis):

First Year

First Semester

Course No.	Course Title	Cr. hrs.	Prerequisite	Co-requisite
GB760	Sustainable Building Systems	3	-	-
GB761	Introduction to Sustainable Construction Methods	3	-	-
SABE724	Research Methods	3	-	-
	Total	**9**		

Second Semester

Course No.	Course Title	Cr. hrs.	Prerequisite	Co-requisite
GB762	Sustainable Building Assessment	3	GB760	-
GB763	Sustainable Building Simulation	3	GB761	-
SP770	Sustainable Planning I	3	-	-
	Total	**9**		

Second Year

First Semester

Course No.	Course Title	Cr. hrs.	Prerequisite	Co-requisite
GB764	Sustainable Urban Concepts	3	-	-
GB780	Project Management and Building Laws	3	-	-
-	Elective Requirement (1)	3	-	-
	Total	**9**		

Second Semester

Course No.	Course Title	Cr. hrs.	Prerequisite	Co-requisite
SP 785	Project Management and Implementation	3	GB761 or SP780 or AC748	
SABE725	Professional Practice Skills	3	SABE 724	
GB710 or GB711	Elective Project Requirement	3	GB761	-
	Total	**9**		

Summer Semester

Course No.	Course Title	Cr. hrs.	Prerequisite	Co-requisite
GB799E	Comprehensive Exam	0	-	-
	Total	**0**		

Courses Description

Field 1: Projects

GB710 Special Projects in Sustainable Buildings, 3 Crs.

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.

GB711 Special Projects in Implementation Management, 3 Crs.

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.

Field 2: Theory and Society

SABE 724 Research Methods, 3 Crs.

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.

SABE 725 Professional Practice Skills, 3 credits.

This course prepares the students to write assessment reports to a real case as discussed and approved by course instructor. It could embody technical; appraisal reports as well as analytical report of a spatial planning real case.

Field 4: Built Environment

SP 742 Land-Use Planning and Legislations, 3 Crs.

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.

Field 5: Technology

GB750 Glass Facades glass

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.

Field 6: Sustainability

GB760 Sustainable Building Systems

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

GB761 Introduction to Sustainable Construction Methods

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.

GB762 Sustainable Buildings Assessment

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.

GB763 Sustainable Building Simulation

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.

GB764 Sustainable Urban Concepts

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.

GB765 Strategy for sustainable construction, 3Crs.

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

Field 7: Environment

ERE 733 Energy Efficiency, 3Crs.

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.

ERE 734 Techno Economic Feasibility, 3 Crs

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.

ERE743 Environmental Biotechnology and Bioenergy, 3 Crs.

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.

ERE 744 Climate Change and Predictability, 3 Crs.

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.

ERE752 Water, Energy, and Environment Management, 3 Crs.

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.

ERE771 Energy, Environmental and Water Laws and Policies, 3 Crs.

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.

SP 770 Sustainable Planning I, 3 Crs.

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.

Field 8: Implementation Management

GB780 Project Management & Building Laws

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

GB781 Construction site management, 3Crs.

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.

SP 785 Project Management and Implementation, 3 Crs.

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.

Field 9: Master’s Thesis

GB799E Comprehensive Exam, 0 credits.

After A successful completion of all core and elective courses with a minimum of cumulative average of 75%, students should be able to pass a comprehensive, four hours, exam. To pass, the student should have an overall grade of minimum 70%. The exam aims to measure the student’s ability to understand and link the basic and advanced concepts they have learned throughout their study duration.