

Minor Program in

**CLIMATE CHANGE AND
SUSTAINABILITY POLICY**

at the University of Jordan (UJ)

In cooperation with TEMPUS

(Trans-European Mobility Scheme for University Studies)



Introduction

Higher Education plays a critical role in making a healthy, just, climate-neutral and sustainable society. It prepares most of the professionals who develop, lead, manage, teach, work in, and influence society's institutions. While recognizing that our region's contribution to the damage of the global climate is less when compared to developed countries, we do recognize the urgency for meeting the challenge that our region is one of the most vulnerable regions to climate change. Therefore, it is necessary to develop interdisciplinary learning, curricula and teaching. The wider objectives are to transform current unsustainable practices with respect to interdisciplinary collaboration and promote interdisciplinary climate change curricula at the universities involved in the project. Specific objectives include:

- 1) Building interdisciplinary and stakeholders' driven climate change curricula responsive to societal needs;
- 2) Develop an undergraduate interdisciplinary program on climate change and sustainability policy (CLIMASP) at the universities involved;
- 3) Integrate, implement and assess the CLIMASP program as an integral part to existing undergraduate academic degrees; and
- 4) Contextualize the Arab-Euro pass diploma in the partner universities and the region.

CLIMASP Minor at the University of Jordan

The Climate Change and Sustainability Policy (CLIMASP) minor at The University of Jordan is an interdisciplinary program funded by the European Commission Tempus under the coordination of the UNESCO Chair ICT in Education for Sustainable Development, University of Crete, Greece. Students from Faculty of Engineering & Technology, The school of Business, and Faculty of Educational Sciences choosing the CLIMASP minor as a complement of their major opens to them new opportunities for further studies and career paths.

The CLIMASP minor consists of core courses, elective courses and the required capstone course in three concentration areas: 1) Climate Change, Environment and Society; 2) Climate Change, Economics and Public Policy; and 3) Climate Change, Science and Technology. The courses included in the CLIMASP minor are an integral part of the participating disciplines curricula. It is, thus, an advantage for students seeking a meaningful and rewarding complement to their main field of study. Upon completion of the minor along with their major, students will be granted the Euro-Arab Pass diploma ranges from 45-60 ECTS.

The University of Jordan in one of the key partners of the CLIMASP project and has decided to provide the opportunity to UJ undergraduate students to

take this minor program enabling them to earn the Euro pass certificate in addition to their B.Sc. in their major specialization. As a pioneer experience, the following UJ Departments are offering courses as part of the CLIMASP minor:

1. Department of Curriculum & Instruction, Faculty of Educational Sciences
2. Department of Business Economics, The school of Business
3. Department of Mechanical Engineering, Faculty of Engineering & Technology
4. Department of Chemical Engineering, Faculty of Engineering & Technology.

The CLIMASP minor program is administrated by the Euro-Arab Center for Interdisciplinary Studies and promotes five key learning processes and outcomes:

1- EXTENDS BEYOND THE 4Cs FOR 21st CENTURY SUCCESS

A 21st century classroom must engage and energize all students to be active participants in building a more sustainable society. In doing so, the CLIMASP minor goes beyond mastering the 4 C's - creativity, critical thinking, communication, and collaboration. In addition, students will be prepared to grasp the skills of connectivity, critical consciousness, critical reflection, cross/inter-cultural competence, co-responsibility and constructing knowledge. All these skills are being highly recognised as the skills that CLIMASP students should be prepared for tackling the complexity of climate change and sustainability policy.

2- APPLIES PROBLEM-BASED LEARNING TO TEACH 21st CENTURY SKILLS

The increased complexity of the climate change and sustainability policy challenges drives us in preparing our students to become inquirers, problem solvers, critical and creative thinkers. The CLIMASP minor provides our students with improved strategies to help them deal with these very complex situations. Problem-based learning (PBL) is one such strategy that is employed throughout the CLIMASP curriculum and teaching methods.

3- VALUING CLIMATE CHANGE AND SUSTAINABILITY POLICY

Every aspect of climate change is shaped by ethical dispute and covers an array of fields: moral philosophy, science, economics, public policy, global justice, energy, and human rights, among others. Applying a values-based and PBL approach, the CLIMASP minor prepares students to comprehend and further explore the intersections of science, ethics, values, climate change and sustainability policy.

4- MERGING THEORY WITH PRAXIS

The CLIMASP curriculum blends classroom learning with experiential, constructivist and transformative practices, incorporating critical self-reflection, argumentation, community service, civic engagement and practicum placements. It adopts a critical pedagogy of sustainability that involves inter- and transdisciplinary engagement with students and community members in an effort to involve students in the process of sustainable thinking and action. In that way, it helps students experience the synergies of the 3Hs- head (cognition), heart (ethics and sentiment) and hand (praxis).

5- LEARNING HOW TO TRANSFORMATIVELY ADAPT

Transformative learning in a climate change context involves climate risk negotiation, identification of vulnerabilities, and both proactive and reactive adaptation. The CLIMASP minor prepares students to learn how to transformatively adapt to the climate change vulnerabilities by seeking out relationships that potentially will help them deconstruct their frames of reference, habits of mind, and unsustainable practices.

Program Structure and Requirements

The interdisciplinary CLIMASP courses consist of core courses, elective courses and a required capstone course in three areas, namely:

Area- A: Climate Change, Environment and Society

Area-B: Climate Change, Economics and Public Policy

Area-C: Climate Change, Science and Technology

Therefore, the student who wishes to benefit from the CLIMASP minor program needs to register and pass the following courses:

- 1) Three core courses (9 Credit Hours), one from each of the Areas (A, B and C).
- 2) Capstone course (6 Credit Hours), which provides practice or training in the field of climate change and environmental sustainability. A combination of 2 such courses with a total of 6 Credit Hours is accepted as capstone course.
- 3) Elective Courses (15 Credit Hours), which can be taken by student from his major B.Sc. program, or from outside his department.

Note: 3 Credit hours are equivalent to 5 ECTS.

The courses are selected from the existing JU programs curricula to produce an interdisciplinary program in CLIMASP with minimum extra courses required by students from the Departments participating in the program.

I. Core Courses:

Table (1): All students of CLIMASP minor should study the following common courses

Area	Course Code	Course Title	Prerequisite	Department	Faculty	Course Category
Environment and Society	2305100	Introduction to Sociology	None	Sociology	Arts	University Elective
Economics and Public Policy	1607100	International Political Economy *	None	Business Economy	Business	University Elective
Science and Technology	0305100	Environment	None	Geology	Science	University Elective

* The students of the School of Business will take Environmental Economics (1607327) instead of International Political Economy.

II. Elective Courses:

Table (2): Courses from the Department of Curriculum and Instruction / Faculty of Educational Sciences:

Course Code	Course Title	Prerequisite	Course Category
0802213	Basic Mathematical concepts and their teaching methods (1)	None	Dept. Core.
0802303	Designing and Producing Instructional Materials	None	Dept. Core
0802313	Basic Mathematical concepts and their teaching methods (2)	None	Dept. Core.
0802317	Child Computerized program	None	Dept. Core
0802391	Instructional Materials for Children	None	Dept. Core
0802414	Child Environmental Education	None	Dept. Core

Table (3): Courses from the Department of Business Economics/ The School of Business:

Course Code	Course Title	Prerequisite	Course Category
1607225	Industrial Economics	1607110	Dept. Core.
1607330	International Trade Theory	1607110	Dept. Core
1607411	Contemporary Economic Issues	1607111	Dept. Core.
1607415	Economic development	1607111	Dept. Core
1607421	Managerial Economics	1607110	Dept. Core.
1607431	International Finance	1607111	Dept. Core
1607327	Environmental Economics	None	Dept. Elective

Table (4): Courses from the Department of Mechanical Engineering / Faculty of Engineering and Technology:

Course Code	Course Title	Prerequisite	Course Category
0904445	Air Conditioning (1)	0904441, 0904342	Dept. Core
0904443	Thermal Power Plants	0904342	Dept. Elective
0904554	Solar Energy	0905441	Dept. Elective
0904453	Refrigeration Systems	0904342	Dept. Elective
0904459	Energy Conversion	0904342	Dept. Elective
0904545	Internal Combustion Engines	0904342	Dept. Core

Table (5): Courses from the Department of Chemical Engineering / Faculty of Engineering and Technology:

Course Code	Course Title	Prerequisite	Course Category
0905371	Fuel and Energy	0905343	Dept. Elective
0905471	Energy Conservation and Management	0905371	Dept. Elective
0905473	Environmental Engineering	0905342	Dept. Core
0905474	Waste Water Treatment	0905473	Dept. Elective
0905475	Air Pollution	0905421	Dept. Elective
0905573	Solid Waste Management	0905473	Dept. Elective
0905542	Water Desalination	0905442	Dept. Elective

III. Capstone Courses for the Three Areas

Course Code	Course Title	Prerequisite	Department / Faculty	Course Category
0832419	Practicum (2) for Classroom Teacher	0802319	Curriculum and Instruction / Faculty of Educational Sciences	Dept. Core
0832499	Practicum (2) Child Education	0802399	Curriculum and Instruction/ Faculty of Educational Sciences	Dept. Core
1600150	Community Service	None	Business Economics / Business	Uni. Requirement
1607311	Scientific Research in Economics	1607150	Business Economics	Dept. Core
0904599	(Final Year) Project	Completing 124 C.H.	Mechanical Engineering	Dept. Core
0905599	(Final Year) Project	Completing 124 C.H.	Chemical Engineering	Dept. Core
0900500	Practical Training	Completing 120 C.H.	Mechanical and Chemical Engineering	College Requirement

The Certificate:

Passing the 30 credit hour courses of this program successfully (equivalent to 50 ECTS) as given above enables the student to apply for the Arab-Euro Pass Diploma in Climate Change and Sustainability Policy. The certificate will be granted jointly by the JU and other European universities (University of Crete, Leuphana University Lueneburg, and Frederick University) which are the EU representative in the project.

HOW TO APPLY

Students must have completed at least one semester before applying to the CLIMASP Minor programme. The application must be accompanied by an approval from the CLIMASP faculty advisor.

1. To register in the CLIMASP minor program, contact the program coordinator in your faculty (See below). He/she will be your advisor for CLIMASP courses throughout your study.
2. Plan to take CLIMASP courses early when you register to your B.Sc. Major courses.
3. Give care to course prerequisites before you register to avoid studying unnecessary courses and make a written plan with the help of your CLIMASP advisor.
4. The program encourages interdisciplinary learning and thus tries to select courses from different fields within the prerequisite and other curriculum constraints.

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COURSE DESCRIPTION

Core Courses

- 2305100 Introduction to Sociology**
The relationships between Sociology and other sciences, its methods, basic concepts such as social structure, culture, identity, social institutions, social stratification, social problems, and social change .
- 1607100 International Political Economy**
This course seeks to explore the interaction of economics and politics in global affairs- the struggle for power and wealth- within the international system. The course begins by identification of the economic science and economic problem, the development of economic thought across different economies schools, concentrating on their different standpoints regarding the role of the government in the economic activity. The course aims also to study and analyze different economic systems and their characteristics. Other topics of interest will be introduced such as the flow across borders of goods, capital, foreign investment and migration; environmentally sustainable development and climate change.
- 1607327 Environmental Economics**
This course tries to shed the light on a very important issue that started to affect all aspects of our life. Students will be introduced to the environmental issues from economics point of view. It offers an integrated understanding of environmental and natural resource economics. Important principles and concepts will be presented to provide students with clear understanding for contemporary environmental issues such as climate change, environmental pollution, natural disasters and natural resource and policy considerations.
- 0305100 Environment**
This course aims at introducing the student to the rudiments of environmental science whose corner stone was laid in the second half of the 20th century. This is being accomplished by discussing the following topics: The earth and natural hazards; Ecosystems; Biogeochemical Cycles; Man and the Environment and the Natural Resources in the Solid Earth System; Air Pollution; Water Resources, management and Pollution; Solid Waste; Food and Health; Environmental Impact Assessment.

Environment & Society Courses

- 0802213 Basic Mathematical concepts and their teaching methods (1)**
This course discusses some mathematical concepts and their methods of teaching, such as: numbers, metric system, nation and proportion, prime and composite numbers, and other geometrical concepts such as area and volume, Also this course discusses mathematical goals and objectives
- 0802303 Designing and producing Instructional Materials**
Introduces the concept of instructional materials; definition; relationship to instructional technology; classification; sources; role of such materials in the instructional process; the impact of perception and communication on designing different kinds of instructional materials such as transparencies, slides, audio cassettes, video tapes, and computer disks; principles of designing, producing and using instructional materials according to the system approach; practical application in designing, producing and using instructional materials in different subject matters.
- 0802313 Basic Mathematical concepts and their teaching methods (2)**
This course discusses current trends of teaching elementary mathematics with the concentrating on constructivism. Also, this course focuses in different strategies of teaching mathematical concepts, generalization, skills and problem solving. Finally, this course focuses on teaching of some geometrical concepts such as points, lines, and congruence and similarity.
- 0802317 Child Computerized program**
This course discuss some child computerized programs (software) for the purposes of instruction, fun, and literacy. The importance of the computerized programs assisted child creative thinking and develop different skills. In addition to that children will learn some basic skills in design, production analyzing and evaluating some computerized programs and some applications on it.
- 0802391 Instructional Materials for Children**
Identifies educational materials for children: their importance, sources and types, Choosing ready – made materials according to appropriate criteria and identifying their uses in the classroom. Students will learn to design needed materials which promote children’s thinking abilities such as classification, sorting, numbers, special relations, measurement, time, causality... etc. Emphasis is also placed on designing materials in ways that enhance children’s total development and also to judge the efficiency of the produced learning materials.

0802414 Environmental Education Child

This course will include: Environmental education concept, the importance of integrating it with other subjects, ecosystems, sustaining, natural resources, environmental problem, desertification, distinction, green house effect, environmental pollution, effects of natural phenomena and environment, protecting and managing environment, and national and international safety, science, technology, society and human. Also integrated approach in designing and implementation environmental curriculum will be included.

0832419 Practicum (2) Classroom Teacher

This course aims to enable students to practice teaching ; training student teachers to plan and prepare for activities; activity management; management of groups; methods of teaching; assessment techniques; individual differences; developing thinking skills. Students are supposed to spend a whole day at school , and discuss this in a weekly meeting at the university.

0832499 Practicum (2) Child Education

This course aims to enable students to practice teaching, training student teachers to plan and prepare for activities; activity management; management of groups; methods of teaching; assessment techniques; individual differences; developing thinking skills. Students are supposed to spend a whole day at a Jordanian kindergarten, and discuss this in a weekly meeting at the university.

Economy & Public Policy Courses

- 1607225 Industrial Economics**
Industrial organization is essentially a branch of applied microeconomics which seeks to understand the causes and effects of various market structures on pricing and product choices. The course focuses on the theory of the firm and the industry in imperfectly competitive markets. We will also explore the environmental and climate change issues that are related to industrial economics topics.
- 1607330 International Trade Theory**
In this era of globalization and regionalism it is imperative that students of economics be adequately informed on the theories and policies concerning transactions of goods and services and factor movements among nations. This course analyzes the causes and consequences of international trade on trading partners and among different groups within each country. Various theories of international trade will be explained and evaluated. The relation between international trade from one hand, and climate change, the environment and sustainability on the other, will be also discussed.
- 1607411 Contemporary Economic Issues**
This course is primarily concerned with contemporary economic issues at the domestic, regional and international levels. Specific topics are chosen from current and recent policy debates. Specifically, it will emphasize current economic subjects such as poverty and welfare, economic growth and development, inflation, energy prices, climate changes and environmental pollution.
- 1607415 Economic Development**
This course introduces the theory of growth and economic development, providing a qualitative and analytical perspective of economic transformation of developing countries for undergraduate students. It tries to provide an explanation for the exceptional progress that has been made in many parts of the developing world, but fully deals with the massive problems and challenges that remain to be addressed in the years ahead such as poverty inequality and development, the environment and development, basic issues in Global warming and climate change and its fallout on economic development.

- 1607421 Managerial Economics**
Economic theory is the fundamental determinant of firms' profitability and growth, and economic thinking should be an essential element in nearly every managerial decision. In this course, we will examine the principles of microeconomics, and show how they apply to managerial decision-making specifically in the environmental issues and climate change.
- 1607431 International Finance**
This is a course in international monetary economics, which includes the connection between the exchange rates and international macroeconomic policies. The subject of international finance draws its importance from the consequences of worldwide economic policies on a country economy's main outcomes (Employment, National Saving, and Trade Balance). The students will be challenged to employ this analytical framework to real-world applications, and try to link the global financial crisis with the climatechange issue.
- 1600150 Community Service**
The student is required to spend eight weeks at a public institution or private company where he/she practices what he/she learned regarding climate change effects, environmental issues and policies of sustainable development. A detailed report is required be the end of service discussing activities and learned skills during this experience. The institution is also required to report the attendance and performance of the student.
- 1607311 Scientific Research in Economics**
The concept of scientific research and its definition, and kinds of scientific research, stages and objectives of scientific research, kinds and sources of data and data collection: Questionnaire, population and sample: kinds of sampling, the relation between statistics and scientific research, implementation and analyzing data using statistical methods with SPSS, finally writing reports with focus in the climate change issues.

Science & Technology Courses

- 0904443 Thermal Power Plants**
Review of power cycles related to steam and gas turbine power plants; types and characteristics of steam power plants including Mechanical Engineering 2005 21 various plant components; water treatment; corrosion; load management; power plant economics. Environmental aspects.
- 0904445 Air Conditioning (1)**
Review of psychrometry; thermal comfort; air conditioning processes; inside and outside design conditions; heating load calculations, infiltration; cooling load calculations, solar gain; heating systems, design, layout; hot water, steam, hot air systems; under floor heating.
- 0904453 Refrigeration Systems**
Basic definitions and concepts; review of vapor compression and absorption cycles; compressors, condensers, evaporators, expansion devices; refrigerants; cooling towers; components of an absorption cycles, controls.
- 0904459 Energy Conversion**
Energy classification, sources and utilization; Energy growth and economics; Fossil-Fuel Systems and combustion in steam power plants. Steam generators. Boiler rating and performance. Environmental aspects of thermal power plants. Overview on renew-able energy sources with emphasis on solar and wind energy systems. Introduction to direct energy conversion systems; Thermoelectric, photovoltaic and thermionic converters. Energy Storage.
- 0904545 Internal Combustion Engines**
Fundamentals of engines and their types. Review of air-standard, fuel-Air and actual cycles. Fuel and combustion. Fuel feeding systems. Engine testing and performance characteristics. Air pollution. Forced induction systems. The course also includes an experimental part which allows the student to estimate the performance of both spark ignition and compression ignition engines, effect of some parameters on engine performance like ignition timing, Air/Fuel ratio, compression ratio and perform an energy balance of the compression ignition engine.

- 0904554 Solar Energy**
Fundamentals of solar radiation; methods of solar radiation collection; thermal systems components and analysis; transfer of collected heat; storage of collected heat; domestic hot water system; introduction to solar energy applications.
- 0900500 Practical Training**
Engineering Students are required to enroll in practical training (internships) in the field of their study for a minimum period of eight weeks. The trainee should submit a technical report (in English) for his/her training experience. The report should include adequate sections to describe the experience gained and recommendations for improvement of the training process. Weekly progress reports signed by the training supervisor are also required.
- 0904599 Project**
The project extends over a two-regular-semesters period. In the first semester, students (individually or in teams) are assigned engineering problems which may be theoretical, experimental or both and contains a major design component. In the first semester, the students study the problem assigned and its theoretical background, set the approach, conduct a literature review, make the problem analysis and preliminary design and write a proposal including a cost estimate and time table for implementation over the second semester. In the second semester, the students carry out detailed design, construction and testing (if any), write a comprehensive report on the work as per the format posted on the department web site. The report should include, where applicable, economical and environmental assessments. The project work is presented by the students to an examination panel who judge the work.
- 0905371 Fuel and Energy**
Energy classification, sources and utilization. Non-renewable Energy: fossil fuels and Nuclear energy. Renewable Energy: solar energy, wind power, tidal power, and geothermal energy. Fossil-fuel systems and applications. Energy storage: chemical storage, thermal storage and fuel cells.
- 0905471 Energy Conservation and Management**
Review of energy sources and their applications. Energy auditing. Energy conservation in industrial and commercial sectors. Choice of fuel. Waste heat recovery systems. Energy economics and economic use of electricity. Process integration for efficient use of

electricity.Process integration for efficient use of energy including energy cogeneration, selection of heat transfer equipment and enhancement of heat transfer.

093473 Environmental Engineering

Concepts and terminology. Sources and impacts of water pollutants. Conventional water and wastewater treatment processes: Sedimentation, flocculation, softening, filtration, disinfection and biological systems. Sources and impacts of air pollutants. Air pollution control through gas cleaning devices: cyclones and wet scrubbers. Solid waste classification, handling and ultimate disposal

0905474 Waste Water Treatment

Overview of water pollutants.Local and international standards for wastewater from industry effluents.Standard methods for wastewater treatment.Primary, secondary and tertiary treatment methods for wastewater such as flocculation, settling, flotation, filtration chemical treatment, biological treatment, sludge treatment and disposal.Membrane separation and adsorption.

0905475 Air Pollution

Air pollutants and sources of air pollution.Ventilation of confined space. Air streams including stack emissions and exhaust fans. Introduction to air dispersion, Gauss model.Local and international standards for air pollutants.Wet and dry air pollution control methods.Air pollution control instruments.Air sampling and measurement of pollutants.

0905573 Solid Waste Management

This course examines methods of managing solid and hazardous waste, with an emphasis on pollution prevention. Topics covered include relevant local and international legislation, recycling, incineration, landfill operations, management of radioactive waste, remediation of waste sites and site worker health and safety.

0905542 Water Desalination

Need for water desalination: Review of local, regional and worldwide water resources, Drinking water standards, Types and properties of saline waters. Water desalination technologies and criteria for process selection. Detailed description and design and operational aspects of commercial desalination methods mainly MSF, MEE, VC and RO including scale formation problems and pretreatment requirements. Post treatment of product water.

0900500 Practical Training

Engineering Students are required to enroll in practical training (internships) in the field of their study for a minimum period of eight weeks. The trainee should submit a technical report (in English) for his/her training experience. The report should include adequate sections to describe the experience gained and recommendations for improvement of the training process. Weekly progress reports signed by the training supervisor are also required.

0905599 Project

Project duration is two semesters. Students are allowed to register in project (1) after completion of 124 credit hours. Each student performs a detailed study of a chemical engineering problem from the selected process chosen in project (1). The final report submitted by the group should include mass and energy balances, process flow diagram and detailed design of one or more items of equipment and other equivalent tasks.