**Sustainability Courses**

**Faculty: Faculty of Graduate Studies**

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| **Department (Program):** Master in Smart Grids Engineering |
| **course number** | **Course name** | **C.H** | **Related to sustainability** (social, environmental, cultural, economic) | **Type of the course****(Mandatory or elective)** | **Course description** |
| 17141100 | Introduction to Smart Grids | **3** | **social, environmental, cultural, economic** | Mandatory | This course mainly focuses on background and fundamental building blocks of smart grid with stringent emphasis on practical applications in the existing power system network. This course provides overview of smart grid and its potential in different types of power sectors such as power generation, transmission and distribution in Metro, Urban/Semi urban and remote locations. This also emphasizes on renewable energy source integration in present grids as well as in micro and Nano grids as part of the course and explores its issues in operation, analysis, management, control, protection and monitoring. In addition to it, this further provides detailed utility level analysis in terms of energy management, network analysis and operation of renewable based smart grids |
| 17141101 | Operation and Control of Power Systems | **3** | **social, environmental, cultural, economic** | Mandatory | This course focuses on the following: A Review for (Power System Analysis; Admittance Model of Power System Elements; Power Flow Analysis; Programming Consideration for Large Systems (Simulation Techniques); AC-DC Power Flow); Fault Analysis of power systems; control, diagnostics and protection of power systems; Structure of Palestinian Power System; Palestinian Electricity Grid Code; Optimum Load and Economic Dispatch; Power Generation Coordination, Scheduling and Control; Voltage control in power systems; MVAR Control; Power Interchange Between Grids; Energy Banking-Power Pools; Power System Security. |
| 17141102 | Discrete Mathematics and Optimization techniques | **1** | **environmental, economic** | Mandatory | Introduction to Complex Decision Problems; Mathematical Programming; Multiple-Criteria Decision Analysis and Multi-Attribute Utility Theory; Theory of Decision under Uncertainty; Game Theory and Group Decision-making; Theoretical foundations of discrete mathematics and algorithms; Mathematical tools for combinatorial optimization; Concepts of optimization; Classical Optimization Techniques; Unconstrained and Constrained Optimization; Dynamic programming.Application of Soft Computing Techniques in Physical Systems; Optimization Techniques; Learning Process and ANN Models; Fuzzy Set Operations and Control Systems; Genetic Algorithm; Other Optimization Techniques; Case Studies on Using Optimization Techniques in Engineering Problems. |
| 17141103 | Renewable and Distributed Generation | **3** | **social, environmental, cultural, economic** | Mandatory | Principles of Renewable Energy and Distributed Generation; Operation of Distributed Energy Resources (DER): Photovoltaics, Wind, Fuel Cells, Hydro Power, Biomass; Geothermal, etc.; Hybrid Power Generation Technology; Distributed Generation Control; Economics of DER; Grid Interface and Synchronization; Control Methods and Applications; Control of DG Inverters; Current Control and DC Voltage Control for Standalone and Grid Parallel Operations; Protection of the Converter; Control of Grid Interactive Power Converters; Energy storage systems. |
| 17141104 | Energy Management and Engineering Economics | **1** | **social, environmental, economic** | Mandatory | Energy Auditing and Economics; Electricity Tariff Types, Energy Economics; Reactive Power Management; Energy Conservation in Lighting and Electric Drives; Peak Demand Controls, Energy Management Opportunities with Electric Drives and Electric Heating; Computer Aided Energy Management; Energy Management System for Smart Grids.Sustainable Development: Economic Dimensions and Environmental dimension; Framework for Sustainability; Technology and Sustainable Development; Power System Economics; Economic Dispatch and Optimization; Transmission Networks and Electricity Markets; Investing in Generation and Transmission; New opportunities of the energy management field; Market Models; Financial Transmission Rights; Feasibility Studies. |
| 17141105 | Data Acquisition and Metering Systems | **3** | **environmental, economic** | Mandatory | Data Acquisition Systems(DAS): Objectives, General configurations, Transducers, Signal Conditioning, Instrumentation Amplifiers; Noise Reduction Techniques in Signal Conditioning; Nyquist’s Sampling Theorem; Classification and Types of Filters: Design of Filters and their Application in DAS; Analog-to-Digital Converters(ADC); Multiplexers and De-Multiplexers; Digital-to-Analog Conversion(DAC); Data Transmission Systems; Modulation Techniques and Systems; Telemetry Systems; Study of a Representative DAS Board; Interfacing Issues with DAS Boards; Software Drivers, Virtual Instruments, Modular Programming Techniques; Bus Standard for Communication between Instruments; Software Design Strategies for DAS; Advanced Metering Infrastructure (AMI); Communication Technologies for AMI; AMI Data Analysis/Analytics. |
| 17141201 | Advanced Power Electronics Applications | **3** | **environmental, economic** | Mandatory | D.C. Chopper Circuits; Line Frequency Diode Rectifiers; Three Phase Half Wave Rectifier with Resistive Load; Three phase full wave rectifier; Line Frequency Phase-Controlled Rectifiers and Inverters; Single Phase Input Line Current Harmonics and Power Factor; Inverter Mode of Operation; Three Phase Half Wave Controlled Rectifier with RL Load; Half Controlled Bridge with RL Load; Fully Controlled Bridge with RL Load; Input Side Current Harmonics and Power Factor; Dual Converters Switch-Mode dc-ac Inverters; Single Phase Inverters; PWM Principles; Sinusoidal Pulse Width Modulation in Single Phase Inverters; Three Phase Inverters; Three Phase Square Wave /Stepped Wave Inverters; Three Phase SPWM Inverters Output Filters; DC Side Current Converters for Static Compensation; Standard Modulation Strategies; Multi-Level Inverters; Space Vector Modulation; Current Regulated Inverter |
| 17141203 | [Big Data Systems and Analysis](https://www.bradford.ac.uk/repos/modules/2019-20/cos7006-b.php) | **3** | **economic** | Elective | Storing, Managing, and Processing Data at Scale; Software Frameworks for Distributed Storage and Processing of Very Large Data Sets; Distributed Parallel Processing Paradigm (Map Reduce Framework); NoSQL Concept, and the Real Time Data Processing; NoSQL Databases; Column-Family NoSQL; Key-Value NoSQL; Graph Database; Document-based NoSQL. They all share the flexibility in use and the ability to handle data at scale and to run on cluster of cheap machines. |
| 17141204 | Smart Buildings and [Internet of Things](https://www.bradford.ac.uk/repos/modules/2019-20/cos7039-b.php) | **3** | **social, environmental, cultural, economic** | Elective | Intelligent Building Characteristics; Building Automation Systems & Controls; Modern Intelligent Vertical Transportation Systems; Information and Communication Technologies (ICT) in smart building technologies; Mobile Applications in Smart Building Technologies; Building Management System (BMS); Structured Cabling Systems; Integrating the Technologies and Systems; Physical Design of IOT; Logical Design of IOT; IOT Enabling Technologies; IOT Levels; IOT Physical Devices & Endpoints; Integrating Internet with Smart Building Technologies. |
| 17141205 | Information and Communication Technologies | **3** | **environmental, cultural, economic** | Elective | Information Theory and Basic Techniques Pertaining to Common Information Sources and Communication Channels; Methods of Designing Practical Error-Correcting Code Using Probabilistic Inference; Definition and Proof of the Security Used in Present-Day Encryption Technology; Advanced Communication Network Control Technology; Mobile Communications Technology; Data Communications and Signal Processing; Information and Communication Technology; Characteristics of Communication Networks; Theoretical Basis for Data Communication, Direct Link Networks; Wireless LAN; SCADA Networks; Remote Terminal Units (RTU); Intelligent Electronic Devices (IED); Industrial Communication Network Technologies; Wired and Wireless Methods and Fiber Optics; Open Standard Communication Protocols. |
| 17141206 | SCADA Systems and Applications  | **3** | **social, environmental, cultural, economic** | Elective | Introduction to SCADA Systems; Fundamental Principle of Modern SCADA Systems; Monitoring and Supervisory Functions; Real Time Systems; Supervisory Control; Direct Digital Control; Application Area of SCADA system; SCADA System Components; Remote Terminal Unit-(RTU); Intelligent Electronic Devices (IED); Programmable Logic Controller (PLC); Communication Network; SCADA Server; SCADA/HMI Systems; SCADA Architecture: Various SCADA Architectures; SCADA Communication: Various Industrial Communication; Open Standard Communication Protocols; Operation and Control of Interconnected Power System; Automatic Substation Control; Distributed Control; PC Based Automation; Distribution Automation System; SCADA Configuration; Energy Management System; System Operating States; Comparison of Performance Different Types of Control with Examples on Software Packages; Case Studies; Simulation Exercises. |
| 17141207 | Power Quality issues in Distribution Systems | **3** | **social, environmental, cultural, economic** | Elective | Power Quality Issues in Distribution Systems; Need for Power Quality Monitoring; IEEE Guides; Standards and Recommended Practices; Power Quality Conditioners for Smart Grid; Modeling of Networks and Components under Non-Sinusoidal Conditions; Harmonic Analysis; Effects of Power System Harmonics on Power System Equipment and Loads; Harmonic Elimination Techniques; Power Quality Management in Smart Grids; Electromagnetic Interference; Transients in Power Systems; Protection Against Transients; Voltage Stability Analysis; Web based Power Quality monitoring.. |
| 17141208 | Protection Systems in Smart Grids | **3** | **environmental, economic** | Elective | Power System and Power System Protection Calculations; Symmetrical Component Methods; Use of Software Programs For Fault Calculations; Protection Technologies; Instrument Transformers; Circuit Breakers; Protection of Power Transformers; Protection of Power Systems with High Degree of Renewable Energy Sources; Directional relays; Distance relays; Differential Relay; Protection of HVDC Networks; Protection of Power Cables and Lines; Protection of Substations; Protection of Motors; Protection of Generators; Frequency and Voltage Protection; Special Protection Functions; Testing of Power System Protections; Trends in Power System Protection; Protective Relaying; Static and Digital Relays; Failure Investigations; Protection Issues for Micro-Grids; Digital Protection of Smart Grid Systems;  |
| 17141209 | Electric Vehicles Integration into Smart Grids | **3** | **social, environmental, cultural, economic** | Elective | Introduction to Electric Vehicles; Conventional Vehicles; Hybrid Electric Drivetrains; Electric Propulsion Unit; Configuration and Control of DC Motor Drives; Induction Motor Drives; Permanent Magnet Motor Drives; Switched Reluctance Motor; Energy Storage Requirements in Hybrid and Electric Vehicles; Sizing the Drive System; Design of a Hybrid Electric Vehicle; Energy Management Strategies, Integration of Electric Vehicles into Smart Grid.  |
| 17141210 | Smart Grid Planning and Operation | **3** | **environmental, economic** | Elective | Power System Concepts; Loads and Energy Forecasting Analysis - Analysis of Time Series; Planning, Design and Operation Methodology; Distribution Load Flow; load forecasting; Optimal Location of Substation; Optimization of Distribution Systems; Optimum Phase Sequence; Distribution Automation; Power System Reliability; Consumer Services; Energy Metering – Tariffs; Deregulated Systems; Static VAR System; Loss Reduction and Voltage Improvement. |
| 17141211 | Energy Storage Systems | **3** | **social, environmental, cultural, economic** | Elective | Energy Storage Techniques; Role of Energy Storage Systems; Energy Storage Classification; Electrical. Efficiency of Energy Storage Systems; Lead Acid Batteries; Lithium Batteries; Chemical Energy Storage Systems; Hydrogen Fuel Cell; Thermal Energy Storage Systems; Combined Heat and Power and Thermal Energy Storage; Mechanical Storage Systems; Pumped Hydro Storage (PHS); Compressed Air Energy Storage (CAES); Flywheel Energy Storage (FES); Hydrogen (H2); Synthetic Natural Gas (SNG); Economics of Energy Storage;  Energy storage in Micro Grids and Smart grids; Energy Management with Storage Systems; Simulation of Energy Storage systems and its Management; Smart Park; Electric Vehicle Charging Facility. |

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| **Department (Program):** Master Agricultural Biotechnology |
| **course number** | **Course name** | **C.H** | **Related to sustainability** (social, environmental, cultural, economic) | **Type of the course****(Mandatory or elective)** | **Course description** |
| 17011621 | Advanced Plant Biotechnology | 3 | environmental, cultural | Mandatory | The fundamental aspects of techniques for DNA cloning, including gene engineering and introduction into host cells. Isolation and detection of specific DNA sequencing. Techniques to engineer domestic plants to improve their productivity and adaptability to the environment. |
| 17011631 | Biotechnology in Crop Protection | 3 | Social; economic | Mandatory | Biotechnology for biotic stress tolerance insects, fungi, bacteria, viruses, weeds. Constructing molecular maps, molecular tagging of genes/traits, marker. Assisted selection of qualitative and quantitative traits, insect sex determination, behavior, systematic and evolution, ecology, transgenic beneficiales in IPM. |
| 17011721 | Advanced Microbiolog | 3 | Environmental;Economic | Elective | Nature of microbial world, the protests, the prokaryotes: an introductory survey The effect of environment on microbial growth, the relations between structure and function in prokaryotic cells, the viruses, classification of bacteria, the photosynthetic prokaryotes microorganisms as geochemical agents, symbiosis, microbial diseases of plants The exploitation of micro-organisms by man industrial, agricultural, environmental. |
| 17011771 | Environmental Biotechnology | 3 | Environmental;Economic | Elective | Environmental biotechnology utilizes microorganisms to improve environmental quality. These improvements include treatment of contaminated waters and wastewaters, clean up of industrial waste streams, and remediation of soils contaminated with hazardous and toxic chemicals. Environmental biotechnology is essential to society and truly important as a technical discipline. |

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| **Department (Program):** Master Natural Resources and Forest Management |
| **course number** | **Course name** | **C.H** | **Related to sustainability** (social, environmental, cultural, economic) | **Type of the course****(Mandatory or elective)** | **Course description** |
| 17013202 | The principal of Natural Resources Ecology | 3 | social, environmental | Mandatory | The course describes the basic concepts of the ecosystem and how to apply it to different scales for the conservation and management of renewable natural resources (eg plants, animals, water, soil). The course focuses on many biological principles (such as nutrients and water cycles, population growth, biodiversity and how they are affected by their biotic and abiotic environment, how these basic concepts are applied to the effective management of natural resources, how humans influence the ecosystem and natural resources. |
| 17013203 | Forest Ecology | 3 | environmental, cultural,  | Mandatory | The course includes the study of the components and forms of forest ecosystems and the relationship of living organisms with non-living components in the forest environment. The course also examines the concept of forest ecosystem in terms of energy transformations, nutrient cycles, non-living components, biodiversity, the ecological sequence in the forest system and the impact of climate and environmental factors on them. |
| 17013206 | Soil, Water, Plant Analysis | 3 | social, environmental, cultural, economic | Mandatory | The course includes the identification of the correct methods of analysis according to the objectives of the analysis of soil, water and plant. In this course, the most important criteria used in soil, water and plant analysis related to the sustainability of natural resources are studied. Ability to evaluate the results of soil, water, and plant tests to make the appropriate decision in the conservation of natural resources. Definition of toxic elements and critical limit of different elements in soil, plant, and water. Studying and evaluating the quality of wastewater and irrigation water as well as how to use different devices and methods in analyzing the results of research used in agriculture. |
| 17013210 | Conservation and Monitoring of Natural Resources | 3 | social, environmental, cultural, economic | Elective | The course aims to manage the natural resources of water, land, and wind and utilize them in the optimal ways in development projects to achieve sustainability and reduce reliance on industrial inputs and achieve functional and environmental compatibility of projects. The course discusses many experiences of developed and developing countries in finding solutions to employ natural resources in the service of sustainable development. |
| 17013212 | Forest Policy and Environmental Legislation | 3 | social, environmental, cultural, economic | Elective | It aims to introduce forestry policies and environmental legislation in Palestine, the Arab world and the world, and the foundations of forestry policy, forestry law, environmental law and environmental strategy in Palestine, and the works, conventions, and treaties related to the environment and forestry. |
| 17013214 | Wildlife Management | 3 | social, environmental, cultural, economic | Elective | This course covers the definition of wildlife, ecosystems and natural communities, community environment, species-environment, animal behavior, wildlife management and its relationship with food and cover, hunting, water, soil, agriculture, pasture, predators, and forests. |
| 17013219 | Renewable Resources Management | 3 | social, environmental, cultural, economic | Elective | The course covers renewable energy technologies, conversion, use and storage including wind, solar, biomass, hydro, wave, underground, hydrogen and hybrid systems. The course also includes the environmental effects of energy conversion to reduce air pollution and global climate change. This course covers simple engineering calculations for calculating energy and capacity from various renewable energy sources, requirements for integrating renewable energy sources into production, distribution and end-use systems. |
| 17013220 | Natural Resources and Forest Policy and Administration | 3 | social, environmental, cultural, economic | Elective | The course aims to study land policy, public resources, forestry, law and management from multiple perspectives. It covers environmental and administrative decision-making and various problems of contemporary resource management and conflict. The course focuses on a better understanding of the relationships between law and policy and the management of natural resources and forests. |
| 17013221 | Integrated Environmental Management | 3 | social, environmental, cultural, economic | Elective | Describes the stages of an integrated ecosystem management system and how to implement it, applying the principles of environmental management to achieve continuous improvement. It provides a basic understanding of various ecosystem management tools and techniques such as life cycle assessment, environmental auditing, and environmental performance assessment for environmental decision-makers. |

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| **Department (Program):** Master Entrepreneurship in Agribusiness |
| **course number** | **Course name** | **C.H** | **Related to sustainability** (social, environmental, cultural, economic) | **Type of the course****(Mandatory or elective)** | **Course description** |
| 17014026 | Entrepreneurship in Natural Resource Management | 3 | social, environmental, cultural, economic | Elective | This course provides entrepreneur knowledge in impact of natural resource management. Identify patterns of social awareness described by green entrepreneurs and how they may be drawn into the natural resource management process. Draw upon case studies of small businesses to learn how they incorporate their businesses into environmental and social justice causes. A few themes emerged from in-depth interviews with a sample of entrepreneur natural resource management, including: low levels of interest in economic success; high degrees of awareness about the business's environmental impact; and high levels of concern for social justice. In addition, several constructs emerged, which included personal motivation and mission, locality, and a forward-thinking orientation about sustainability. Increase innovative models for incorporating natural resource management as business. |
| 17014027 | Entrepreneurship in Animal Husbandry | 3 | environmental, economic | Elective | Provide the student’s entrepreneur methods in Production from animal enterprises, such as milk, meat, eggs and their various by-products, make their way to domestic and international markets through a complex series of stakeholders and channels. Stakeholders in these livestock production chains have to respond jointly to the changes brought on by technological advancements. They also have to deal with an ever-increasing number of national, international laws, and regulations, such as those governing international food-quality standards and sustainability labels. An overview of the specific concepts and skills related to entrepreneur organization of animal small businesses. |
| 17014028 | Entrepreneurship in Protected Agriculture Management | 3 | social, environmental, cultural, economic | Elective | The course comprises entrepreneurship in plant physiology and developmental biology described in relation to the production of plants, cut flowers, and fruits in different conditions under protected cultivation. Protected horticulture depends on modifying the physical environment of an enclosed space so as to improve the growth and quality of plants. The course also aims in delivering the students entrepreneur knowledge about the physics of a greenhouse and the interaction between crop processes and greenhouse climate processes. |
| 17014030 | Entrepreneurship in Plant Protection | 3 | social, environmental, cultural, economic | Elective | This course gives general understanding of many aspects of biotic stress tolerance against insects, fungi, bacteria, viruses, and weeds. Illustrate the principles of scientific work in plant protection and the ecology of plant protection |

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| **Department (Program):** Master Computer Science |
| **course number** | **Course name** | **C.H** | **Related to sustainability** (social, environmental, cultural, economic) | **Type of the course****(Mandatory or elective)** | **Course description** |
| 17113512 | Advanced Database Systems | 3 | economic | Elective | The course aims at advancing database system topics through combining complexity and a more hands-on experience on modern database systems, such as NoSQL, spatio-temporal, data warehousing databases. Students will concentrate on obtaining knowledge on advanced topics including but not limited to: query processing and optimization, query evaluation, transaction processing, concurrency control and recovery in both a centralized and a distributed environment. In addition, students will learn the single and multi-dimensional indexing methods, join evaluation algorithms and SQL Analytics. |
| 17113528 | Mobile Computing | 3 | economic | Elective | "This course discusses advanced mechanisms that supports mobile computing systems. Topics include developments of various wireless network and their integration with the internet in order to support ubiquitous mobile computing. Advanced routing protocols over heterogeneous network that could combine MANET, VANET, WSN, cellular, and other wired and wireless networks in order to achieve the goal of anytime, anywhere computing. Advanced Mobility management and location-based service management. Data management and organization for mobile computing applications. Security issues in mobile computing environments." |
| 17113548 | Statistics, simulation, and optimization | 3 | environmental, economic | Elective | The course gives an overview of statistical and simulation-based approaches when dealing with data using programming environments in R and Python. The aim of this course is to give students the ability to focus on the understanding of the statistical methods and their application when dealing with data problem. |

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| **Department (Program):** Master Water Sciences Innovations |
| **course number** | **Course name** | **C.H** | **Related to sustainability** (social, environmental, cultural, economic) | **Type of the course****(Mandatory or elective)** | **Course description** |
| 17120102 | Water Energy Food Nexus | 3 | social, environmental, cultural, economic | Mandatory | This course introduce the knowledge of nexus, and the link between water-energy-food. Understand the use of alternative energy to improve water resources in term of quantity and quality, use of alternative energy in improving food production (heating and cooling). The course offer students how to calculate water-, energy and carbon footprint in agricultural crops (using life cycle assessment). The course will provide student skills of how to use water-energy sources in proper way in producing food. In addition, it discusses the environmental impacts of renewable energy on reducing carbon dioxide emission, and the consequences on climate change. |
| 17120103 | Water Quality | 3 | social, environmental, cultural, economic | Mandatory | This course aims as introducing the physical, chemical, and biological dimensions of the water quality, and the natural as well as the anthropogenic factors/processes affecting them. Special emphasis will be given to water pollution in terms of composition, sources, fate, control and remediation. Environmental isotopes as an effective tool for water scientist working in arid and semi-arid regions will be exploited. Water quality regulations will be presented. Planning and setting up water quality monitoring and assessment programs will be introduced. Students will be able to display, characterize, interpret, and model water quality data, using different methods and techniques such as statistical, GIS, and specialized software. They will be able to build up water quality indices. They will be also able to apply isotopic methods in water quality management. |
| 17120104 | Climate Change & Water Sustainability | 3 | social, environmental, cultural, economic | Mandatory | The course includes the general concepts of climate driven parameters, and climate change throughout the history of the earth, and the impact of climate change on life development in water and terrestrial. The course also discusses the roles of industrial revaluation and increase immersion of greenhouse gasses on climate change. It provides student different intellectual skills of how to demonstrate the impact of climate change on water resources, and other relevant biotic/a biotic parameter. to It introduce also the negative impact of climate change on the population migration/immigration. It also explains the adaptation/mitigation measures needed to meet effect of climate change. This course also introduce professional skills of how to build up conceptual climate change model, and how to use different software to build up scenarios, and to predict the impact of climate change on water, food, and living standard. |
| 17120201 | Water & Wastewater Treatment | 3 | social, environmental, economic | Mandatory | Water treatment processes are very important to protect water bodies and environment from water pollutants generated by different anthropogenic activities. This course will provide an overview of engineering approaches to remove different types of pollutants (organic, in organic and biological) from water/wastewater with an emphasis on fundamental principles. The course will cover a theoretical principal, practical design configurations and operation of different types of water & wastewater treatment such as physical, chemical and biological processes. The principles of water/wastewater collection, coagulation, flocculation, sedimentation, filtration, biological treatment (primary and secondary), sludge handling, disinfection, advanced water treatment processes and water reuse are presented. Water reuse schemes and risk assessment will be integrated with different treatment processes. Finally, student will be able to learn a preliminary design of water/wastewater treatment plant through descriptive lectures and supervised tutorials, field trips and case studies as well as to select a proper treatment processes to meet effluent requirements according to national and international water reuse guidelines. |
| 17120204 | Entrepreneurship and Innovation in Water | 3 | social, environmental, cultural, economic | Elective | The course includes the general concepts to identify the value chain of water products (software, hardware). Student will expose to knowledge of how to identify, collect relevant data, and integrate professional skills to handle complex concept water product. The course also discusses of how to establish startup, perform, analyze the company environment, design appropriate strategy, and how to test new products and how to predict market response. It introduce also to identify the relevant stakeholders(public, private, NGOs) for the entrepreneurship in water sector. |
| 17120205 | Integrated Water Resource Management | 3 | social, environmental, cultural, economic | Elective | This course introduces first water sources in semi-arid, arid regions, and challenges facing water sector. It discusses methods of sustainability, and management theories. The course includes the effect of increasing water demand in different sectors on the availability, quality of sources. Special attention will give to the economic, environmental impact of the integration concept. It analyzes the interrelations among water sources, water uses, and the important of water sustainability. The course offer student to learn how GIS-technique , and relevant software can apply in managing water sources. |

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| **Department (Program):** Master Software Engineering |
| **course number** | **Course name** | **C.H** | **Related to sustainability** (social, environmental, cultural, economic) | **Type of the course****(Mandatory or elective)** | **Course description** |
| 17150116 | Software for Augmented / Virtual Reality | 3 | cultural | Elective | This course covers the technical and ‎experiential design foundation required for ‎the implementation of immersive ‎environments in current and future virtual, ‎augmented and mixed reality platforms. The ‎curriculum covers a wide range of literature ‎and practice starting from the original ‎Computer Science and HCI concepts ‎following the evolution of all supporting ‎technologies including visual displays for ‎VR, AR and MR, motion tracking, interactive ‎‎3D graphics, multimodal sensory integration, ‎immersive audio, user interfaces, IoT, games ‎and experience design. ‎ |

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| **Department (Program):** PhD Plant Pathology |
| **course number** | **Course name** | **C.H** | **Related to sustainability** (social, environmental, cultural, economic) | **Type of the course****(Mandatory or elective)** | **Course description** |
| 18010101 | Advanced Plant Pathology | 3 | environmental, cultural, economic | Mandatory | Advance information about plant pathogens to understand the mechanisms by which they infect plants. The diversity of plant pathogens will be covered. Environmental factors favor pathogens development. The course will introduce the student to monitoring and surveillance of plant pathogens. |
| 18010202 | Integrated Pest Management | 3 | environmental, economic | Mandatory | Modern theory and practices for management of insect pests and pathogens in plant production systems, emphasizing an ecologically-based, integrated approach. Basic concepts of pest management, decision-making, cost/benefit analysis, and risk/benefit analysis. |
| 18010503 | Bacterial Plant Diseases | 3 | environmental, economic | Elective | Bacteria as plant pathogens, with examination of the taxonomy, genetics, ecology, physiology, host-parasite interaction, and control of phytobacteria. |
| 18010504 | Mycology | 3 | economic | Elective | A systematic study of the fungi, with emphasis on taxonomy, nomenclature, comparative morphology and fungal biology including metabolism, metabolism ecology and reproductive processes. |
| 18010505 | Viral diseases | 3 | environmental, economic | Elective | Plant viruses as causal agents of plant diseases. Taxonomy, biological, chemical, and physiological properties; transmission; host-virus and vector-virus relationships; replication; molecular virology; detection, diagnosis; ecology, biosecurity. |
| 18010508 | Pesticides | 3 | environmental, economic | Elective | The course investigates the performance of pesticides in the field as well as the environment and their toxicology. |
| 18010511 | Stress Physiology | 3 | environmental, economic | Elective | Understand the physiological response of plants to stress factors such as pathogens and environmental factors. |

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| **Department (Program):** Master Science in Cybercrimes & Digital Evidence Analysis |
| **course number** | **Course name** | **C.H** | **Related to sustainability** (social, environmental, cultural, economic) | **Type of the course****(Mandatory or elective)** | **Course description** |
| 17022522 | Applied Cryptography | 3 | social, cultural, economic | Mandatory | This course describes how cryptographic algorithms keys and protocols, and an appropriate hardware (software) environment can solve security problems (confidentiality, integrity, authenticity). It shows how security is achieved in real ¬life systems such as telecom, government/identity, buildings/transportation, payment. Real-life applications of encryption, Message Authentication Codes (MAC) and Digital Signatures and RFID technology are discussed in this course. The student will implement different modern techniques using different algorithms (hardware and software) that are used in cryptography. |
| 17022523 | Network Forensics | 3 | social, cultural, economic | Mandatory | This course details the methodology and procedures associated with digital forensic analysis in a network environment. Students will develop an understanding of the fundamental protocols, tools, equipment and applications required to conduct forensic analysis in a network environment. The student will implement different modern techniques using different tools (hardware and software) in network forensics. |

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| **Department (Program):** Master Public Administration |
| **course number** | **Course name** | **C.H** | **Related to sustainability** (social, environmental, cultural, economic) | **Type of the course****(Mandatory or elective)** | **Course description** |
| 17060616 | Organizational Behavior | 3 | social, cultural, economic | Mandatory | This course deals with the relationship between political science and public administration in terms of theoretical and practical aspects as well as the historical correlation between them. It also reviews the most important political theories related to state administration and its various concepts, by analyzing the political environment representing the legal and constitutional framework of a democratic state. The course also focuses on the development of the concept of the state in the modern era and its relationship to the economic and social developments. It describes the administrative model, which is the executive arm entrusted to achieve the general objectives and policies set by the government. The relationship between politics and administration is one of the most important issues addressed by the course. There are also other topics covered in the program, such as the theory of organization, analysis of public policies, manpower management, government budgets, planning, etc. |
| 17060630 | Public Administration - Theory and Practice | 3 | social, cultural, economic | Mandatory | This course deals with the relationship between political science and public administration in terms of theoretical and practical aspects as well as the historical correlation between them. It also reviews the most important political theories related to state administration and its various concepts, by analyzing the political environment representing the legal and constitutional framework of a democratic state. The course also focuses on the development of the concept of the state in the modern era and its relationship to the economic and social developments. It describes the administrative model, which is the executive arm entrusted to achieve the general objectives and policies set by the government. The relationship between politics and administration is one of the most important issues addressed by the course. There are also other topics covered in the program, such as the theory of organization, analysis of public policies, manpower management, government budgets, planning, etc. |
| 17060712 | Decision Making and Analysis of Public Polices | 3 | social, cultural, economic | Mandatory | This course covers the study and analysis of administrative decision theories in the public domain and the conditions of the decision-making process. It also deals with the process of developing, analyzing and evaluating public policies, especially in Palestine, and the stages of building and developing public policies given a complex environment. In addition, the course provides a comprehensive survey of key theories in public policy making and government decision-making, with a focus on studying analytical models of decision-making process. |
| 17060733 | Public Organizations Design | 3 | social, cultural, economic | Elective | The course is intended to introduce students to the concept and aspects of organizations design, their structures, their advantages and the factors influencing them. It also aims to study the effect of environment, technology, globalization and competitiveness as key variables in designing and building organizations. In addition, it covers the impact of executive and strategic culture, conflict and sources of power on the design and shape of the organizations, especially state organizations. |
| 17060734 | Public Projects Management | 3 | social, environmental, cultural, economic | Elective | This course is intended to introduce the students to public project management, and how it differs from traditional project management. It identifies the various environments affecting public projects and their life cycle, projects programs and project evaluation - through the use of revenue and benefit accounts for the community. It also covers methods of evaluating non-profit organizations projects. |
| 17060736 | Advanced Organization Theory | 3 | Social, economic | Elective | This course includes the fundamental concepts of the organizational theory, its objectives, and its traditional and modern models. It also includes analyses of the organization components, the approaches used in their design, underlying principles, measuring organizational performance, environments affecting organizations, regression and development of the organization, survival techniques, quality culture, build and design of organizational structures, key organizational design. It also includes methods for increase organizational effectiveness through management information systems, and the organization's relationship with Environment, international relations, organizational conflict, creativity, organizational change and development in the 21st century. |

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| **Department (Program):** Master Technical and Vocational Education and Training |
| **course number** | **Course name** | **C.H** | **Related to sustainability** (social, environmental, cultural, economic) | **Type of the course****(Mandatory or elective)** | **Course description** |
| 17070201 | Education: Learning and Teaching in TVET | 3 | cultural, economic | Mandatory | This course is designed for enabling students in understanding and applying key concepts of theories of leaning. It focuses on theoretical aspects of psychology related to learning and behavior. The course deals with key issues in psychology of learning, such as nurture and nature, retention and meaningfulness in learning, cognition and behavior, to name but a few. |
| 17070206 | Designing Technical and Vocational Pedagogy | 3 | social, economic | Mandatory | This course is designed for enabling students to develop, implement, and evaluate instructional design in order to make the learning more effective and enjoyable. It provides students with the fundamentals of instructional design including the principles of learning theory, and instructional strategies that are relevant to instructional design. This course aims to help students on performing instructional design, delivery and evaluation of at least three different types (i.e. constructivists, behaviorists, critical). |
| 17070213 | E-learning in TVET | 3 | social, cultural, economic | Elective | This course is designed for helping students to acquire knowledge and skills of e-Learning strategies and techniques backed up by the use of theories and models that is appropriate to support the e-courses design of print-based, web-based, or multimedia-based instruction. In addition, the focus is given to raise their competency in evaluating existing e-courses instructional practices to make modifications and to determine the value of existing e-courses. |
| 17070223 | Research in Classroom and Workshop | 3 | social, cultural, economic | Elective | This course is designed to covers critical thinking, contemplative thinking, procedural research, a survey session, investigation of student learning processes, teacher practices, learner practices, learning environment, all theese concepts in relevant outcome of the thematic article on TVET related theme based on the extensive literature review under that theme |

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| **Department (Program):** Master Sports Science/ٍ Supervision & Teaching in Physical Education |
| **course number** | **Course name** | **C.H** | **Related to sustainability** (social, environmental, cultural, economic) | **Type of the course****(Mandatory or elective)** | **Course description** |
| 17081130 | Marketing and Sporting Investment | 3 | social, cultural, economic | Elective | This course mainly deals with the essence and importance of investment in the sport field and defining its goals in relation to the target markets. It also deals with defining the concept of the sporting industry, the concept of the life cycle of the product and pricing, the concept of the brand, and its identity and strategy, and analyzing the environment and the mechanism of designing marketing objectives. This course also deals with the essence and importance of marketing care and its goals. |

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| **Department (Program):** Master Electronic Commerce |
| **course number** | **Course name** | **C.H** | **Related to sustainability** (social, environmental, cultural, economic) | **Type of the course****(Mandatory or elective)** | **Course description** |
| 17091720 | E-logistics Services in E-Commerce | 3 | social, environmental, cultural, economic | Elective | E-logistics works as the backbone system for the entire supply chain. Also, it allows smooth information flow inside and among organizations. This course concentrates on the vital role of E-logistics in today's changing global environment. The course also examines how competitiveness and productivity in transport, logistics, and supply chain management can be improved using E-logistics systems and technologies. A variety of successful E-logistics business approaches are presented, including a range of commercial sectors and transport modes. The course further examines growing technologies in E-logistics and considers what the future might hold in this fast-changing and growing field. |
| 17091760 | Digital Economy | 3 | cultural, economic | Elective | This course explained how the digital economy impacts markets, society, and organizations. It will further equip the students with knowledge regarding how the Internet, mobile communications, the sharing economy, social media, and cryptocurrencies impact global businesses. The course includes two sections: (1) Fundamental theory in digital economics, comprising network effects, value creation models, digital business models, and market modeling. (2) How the digital economy impacts societies, environment, regulations, privacy, strategy, and financial operations. |

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| **Department (Program):** Master Financial Economics |
| **course number** | **Course name** | **C.H** | **Related to sustainability** (social, environmental, cultural, economic) | **Type of the course****(Mandatory or elective)** | **Course description** |
| 17132215 | Investment and Risk Management | 3 | social, environmental, economic | Elective | This course provides students with the foundations of modern investment theory. Topics comprise analyzing the investment environment and the risks to which investment is shown, choosing and managing direct and indirect investment tools, and measuring return and risk in different investment circumstances. This course additionally deals with the foundations of making the optimal investment portfolio according to the economic model, investment cases in changing economic conditions, investment portfolio models and evaluating their performance using mathematical measurement models. Finally, this course offers investment and risk management according to efficient market theory and hedging against risks employing different financial methods. |
| 17132216 | Advanced Corporate Finance | 3 | social, cultural, economic | Elective | This course shed light on the general content of financial management in firms through the duties and decisions of financial management and their reflection on the operating environment of organizations with a focus on financial planning and control, which includes: forecasting financial needs, preparing estimated budgets, analyzing financial ratios, break-even analysis and leverages—then shedding light on investment decisions, which have working capital management policies and the link between the component of risk and return in the investment decision, and financing policies, including capital structure policy, cost of capital, profit distribution policy, valuation of corporate securities, and finally, companies’ growth, faltering and restructuring through merger, control, reorganization or bankruptcy. Finally, the course displays the most current trends in performance appraisal (EVA, MVA). |