



**Yarmouk University**  
**Hijjawi Faculty for Engineering Technology**  
**Civil Engineering Department**

**Curriculum**  
**Master of Science**  
**in**  
**Construction Engineering and Management – Thesis**  
**Track**

**2023**

## **Introduction:**

Welcome to the world of Construction Engineering and Management! The Master's degree in Science with a Major in Construction Engineering and Management provides students with a unique opportunity to develop a comprehensive understanding of the theories, principles, and practical applications of these interrelated fields. This program combines the technical knowledge and hands-on skills required to design and construct buildings, structures, and infrastructure projects with the management skills needed to oversee these projects from start to finish. Students in this program will delve into the complexities of structural design, learning about the behavior of materials under different loads and the principles of engineering mechanics. They will also study the latest construction technologies, materials, and methods, and learn how to apply these to real-world projects. In addition, students will develop a deep understanding of construction project management, learning about the planning, scheduling, and budgeting processes involved in delivering projects on time and within budget. The curriculum is designed to provide students with a solid foundation in the theoretical and practical aspects of these fields, as well as to develop their critical thinking and problem-solving skills. Throughout the program, students will be exposed to the latest research and industry practices and will have the opportunity to participate in hands-on projects and internships that will provide real-world experience and help prepare them for successful careers in this exciting and dynamic field. Whether you are a practicing engineer or construction professional looking to deepen your knowledge and skills, or a recent graduate looking to launch your career in this field, this program is the perfect program to help you achieve your goals. So, if you are ready to take the next step in your education and career, join us and start your journey today!

## **First: Program Goals**

1. To provide students with a thorough understanding of the theories, principles, and applications of structural engineering, including the behavior of materials under different loads and the principles of engineering mechanics.
2. To equip students with the technical knowledge and hands-on skills required to design and construct buildings, structures, and infrastructure projects, and to understand the latest construction technologies, materials, and methods.
3. To develop students' ability to manage construction projects from start to finish, including the planning, scheduling, and budgeting processes involved in delivering projects on time and within budget.
4. To promote critical thinking and problem-solving skills, and to expose students to the latest research and industry practices through hands-on projects and internships.
5. To prepare students for successful careers in the Construction Engineering and Management fields, by providing them with a comprehensive education that integrates theoretical and practical components and prepares them for the demands of the modern workforce.

## **Second: Program Learning Outcomes (PLOs):**

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

### **Third: Program Justifications**

1. The creation of this program comes as a response to the royal directives for investment in education mentioned by His Majesty King Abdullah II Ibn Al-Hussein in the seventh discussion paper, from which we quote, “We are able to do that, for here is our human wealth, the most precious of Jordan’s wealth, capable, if it is educated.” Adequate talk, on making the desired change, and we have no choice but to invest in this wealth with all strength and responsibility, as there is no investment that generates as much returns as investment in education.”
2. Growing demand for specialized professionals: The field of Construction Engineering and Management is rapidly growing and there is a high demand for professionals with advanced education and training. This program provides students with the skills and knowledge needed to meet the demands of this dynamic industry.
3. Integration of theory and practice: This program emphasizes the integration of theoretical and practical components, giving students a comprehensive education that prepares them for the challenges of the modern workforce. With a focus on hands-on projects and internships, students gain a deep understanding of the real-world applications of the theories and principles they learn.
4. Advancement in technology: The field of Construction Engineering and Management is constantly evolving, with new technologies and innovations emerging regularly. This program is designed to keep students current with the latest advances in technology and to provide them with the skills and knowledge they need to be at the forefront of this dynamic industry.
5. Importance of project management: Effective project management is critical to the success of any construction project, and this program provides students with the skills they need to effectively manage projects from start to finish. With a focus on planning, scheduling, and budgeting, students learn how to effectively manage projects and deliver them on time and within budget.
6. Global opportunities: The field of Construction Engineering and Management is a global one, with opportunities for professionals to work on projects all over the world. This program provides students with a comprehensive education that prepares them for these international opportunities and equips them with the skills they need to succeed in this competitive field.

7. The availability of the research environment in the Department of Civil Engineering at Yarmouk University. In addition to the integrated infrastructure, is a major factor in paving the way towards finding qualified graduates in these fields, in addition to enhancing opportunities to produce applied research, which contribute effectively to finding contemporary civil solutions in the local community.
8. The last statistics issued by the Jordanian Engineers Association in 2022 indicated that the total number of engineers registered in the union and affiliated with the Civil Engineering Division and its subspecialties was 53,955 engineers, and those in the study were 8,730 engineers, while the number of students enrolled in the study was 4,002. Regarding applications for employment in the Civil Service Bureau, the cumulative applications for employment in the civil engineering professions were 6,236. These figures indicate that the disciplines targeted by the program range from stagnant to saturated. Therefore, developing an integrated program such as the proposed master's program is necessary to develop the skills of engineers holding bachelor's degrees to increase their chances of employment locally, regionally, and globally.
9. As for the study of the public and private labor market regarding the specialization of civil engineering, the latest study issued by the U.S. BUREAU OF LABOR STATISTICS in 2022 regarding civil engineering-related occupations, statistical data showed that employment of construction managers is expected to grow 11 % from 2020 to 2030, faster than the average for all occupations. Over the next decade, the number of civil engineering-related vacancies is expected to average 84,751 yearly. It is also expected that more of these vacancies will result from the need to replace workers moving into different occupations or exiting the workforce, such as retirement.
10. The current number of students in the department reaches (845), while the number of graduates of the program in the last five years was (2,045). Program graduates work in various civil engineering sectors inside and outside Jordan. According to the latest statistics of the Jordanian Contractors Association, there are (1,759) contracting companies in Jordan. In comparison, the statistics of the Jordanian Engineers Association confirm that the number of operating offices is 1,269 until the end of December 2022 (804 engineer offices, 250 engineers, 206 consultants, 9 opinions). Accordingly, the growing demand to find engineers capable of using modern technological means to provide optimal civil engineering-related services, projects based on skill, and deep knowledge of the details of this delicate specialization was one of the reasons for the development of the civil engineering M.S. program at Yarmouk University.
11. Keeping pace with modern trends in civil engineering in terms of sustainability, flexibility, green building, and applications of artificial intelligence by offering specialized courses in these fields within the study plan of the proposed program, as the Kingdom lacks policies and regulations related to green, sustainable, and flexible building projects. To achieve national strategic planning for sustainable and green buildings, ministries and institutions operating in the construction sector need specialists in these modern fields of civil engineering. Thus, the proposed program is designed to create a generation of engineers capable of analyzing and designing sustainable and resilient infrastructure systems to achieve the required sustainable development for the Kingdom.

12. The proposed program will assist the construction industry in the country by providing graduates with the necessary knowledge and a comprehensive understanding of how to achieve the standards of cost, time, quality, safety, and sustainability in engineering projects, as well as through the provision of consulting, studies and engineering research that help decision makers to make appropriate decisions
13. The economic feasibility study (attached) shows that the expected net profits from the program exceed 400,000 Jordanian Dinars.

**Fourth: Degree Requirements**

1. Fulfill the requirement for graduation according to Yarmouk university graduate studies regulations.
2. Accomplish prerequisite courses determined by the Department Graduate Studies committee.
3. Accomplish a total of (33) credit hours as listed below.

**The Study Plan (33) Credit Hours as follows:**

Requirements	Credit Hours
Compulsory Courses	15
Elective Courses	9
Thesis	9
<b>Total</b>	<b>33</b>

**A. Compulsory Courses (15) Credit Hours.**

Course Number	Course Title	Credit Hours	Prerequisite
CE 601	Research Methodologies	3	---
CE 610	Structural Dynamics	3	---
CE 613	Advanced Structural Mechanics	3	---
CE 620	Construction Law and Dispute Resolution	3	---
CE 624	Advanced Quality Systems in Construction Projects	3	---

**B. Elective Courses (9) Credit Hours.**

Course Number	Course Title	Credit Hours	Prerequisite
CE 602	Advanced Applied Mathematics	3	---
CE 603	Advanced Applied Statistics	3	---
CE 604	Smart Cities and Sustainable Development	3	---
CE 605	Sustainability and Resilience of Infrastructure Systems	3	---
CE 606	Artificial Intelligence Applications for Civil Engineers	3	---
CE 611	Advanced Reinforced Concrete	3	---
CE 612	Finite Element Methods	3	---
CE 614	Advanced Steel Structures	3	---

Course Number	Course Title	Credit Hours	Prerequisite
CE 615	Repair and Rehabilitation of Infrastructures	3	---
CE 616	Sustainable Materials for Infrastructures	3	---
CE 617	Advanced Topics in Structural Engineering	3	---
CE 621	Advanced Construction and Building Technology	3	---
CE 622	Advanced Financial Management for Construction Projects	3	---
CE 623	Advanced Risk Management for Construction Projects	3	---
CE 625	Advanced Construction Equipment Management	3	---
CE 626	Sustainable Construction Techniques	3	---
CE 627	Environmental Impact Assessment and Risk Analysis	3	---
CE 628	Advanced Topics in Construction Project Management	3	---
CE 630	Advanced Soil Mechanics	3	---
CE 631	Advanced Foundation Engineering	3	---
CE 632	Behavior and Design of Deep Foundations	3	---
CE 640	Traffic Operation and Flow Theory	3	---
CE 641	Pavement Management Systems	3	---
CE 642	Advanced Pavement Analysis and Design	3	---
CE 650	Advanced GIS and Remote Sensing	3	---
CE 651	Advanced Surface Water Hydrology	3	---
CE 652	Waste to Energy and Materials Recovery	3	---
CE 653	Sustainable Urban Water Engineering	3	---

C. Preparation of a Master Level Thesis and passing its defense exam. The master thesis is **(9) Credit Hours** appearing for registration purposes as follows:

Course Number	Course Title	Credit Hours	Prerequisite
CE 699A	Master Thesis	0	---
CE 699B	Master Thesis	3	---
CE 699C	Master Thesis	6	---
CE 699D	Master Thesis	9	---

**The meaning of tens numbers in the study plan of the Department of Civil Engineering**

- (0) General.
- (1) Structural Engineering.
- (2) Construction Engineering and Management.
- (3) Geotechnical Engineering.
- (4) Transportation Engineering.
- (5) Water and Environmental Engineering.
- (9) Thesis.

## **Fifth: Course Description**

### **CE 601 Research Methodologies**

The course's main objective is to provide graduate students with the necessary background to conduct research in the field of Construction Engineering and Management and prepare them for the research work to be performed during their master program. This course will include an introduction to research methodology, the importance of research in decision-making, defining the research problem and formulation of the research problem, and research designs: exploratory, descriptive, and experimental. Data collection and measurement: methods and techniques of data collection: primary data through communication. Designing questionnaires, qualitative research, sampling, and sampling designs attitude measurement and scales. Data presentation and analysis: data processing, univariate and bivariate analysis, correlational analysis (ANOVA). Model building and decision making. Report writing and presentation: reports' content, formatting, and presentation of reports. Compiling and writing scientific papers.

### **CE 602 Advanced Applied Mathematics**

This course provides applied mathematical and analytical tools for solving practical engineering problems. Topics include first and second ordinary differential equations and solutions, higher order differential equations, series solutions of ordinary differential equations including power series method, Bessel functions, Legendre function, and hypergeometric functions, linear algebra and calculus including matrices, eigenvalues, eigenvectors, vector differential calculus, vector integral calculus including Green's theorem and Stoke's theorem, Laplace transform, Fourier analysis of differential equations, partial differential equations including basic concepts, vibrating strings, D'Alembert solution, wave equation, and the heat equation. Complex functions and conformal mapping.

### **CE 603 Advanced Applied Statistics**

This course covers the comprehensive knowledge of statistical inference to compute and interpret p-values and confidence intervals, all while analyzing construction project-related data with state-of-the-art software packages (e.g., R and Python). Programming examples are provided in a way that will help make the connection between concepts and implementation in solving real-world construction problems. Problem sets requiring programming will be used to test comprehension and capability to execute advanced data analyses. Also, visualization techniques will be employed to investigate new datasets gathered from construction sites and determine the most proper methodology to generate practical solutions. Moreover, statistical techniques using specialized software will be described as alternatives when data do not fit assumptions required by the standard approaches, where scripts are to be used to analyze data for conducting reproducible research in construction project management and engineering.

### **CE 604 Smart Cities and Sustainable Development**

This course aims to provide students with an in-depth understanding of the role of civil engineering in the development and implementation of smart city technologies. The course is designed to explore the integration of advanced technologies and engineering principles in urban planning and management. It covers many civil engineering applications that contribute to the creation of smart cities, including smart transportation systems, sustainable buildings, urban water management, and waste management systems. During the course, students will examine the challenges and opportunities of creating sustainable, resilient, and livable cities. They will learn about using technologies such as the Internet of Things (IoT), big data, artificial intelligence (AI), and cloud computing to improve the quality of life in cities. This course will also address the importance of stakeholder engagement and public-private partnerships in the development and implementation of smart city initiatives through hands-on projects and case studies, providing students with an opportunity to apply their knowledge to real-world situations. This course will also explore the ethical and legal issues surrounding smart city technologies, and the potential impacts of these technologies on urban societies.

### **CE 605 Sustainability and Resilience of Infrastructure Systems**

This course is designed for professionals managing infrastructure assets. It covers topics like pipeline degradation, risk assessment, life cycle costs, and government regulations, with practical applications for decision-making and project management. Students will gain an understanding of infrastructure planning, engineering, and economics, with a focus on management within public works agencies. The course includes analysis of case studies, discussions on different planning strategies, and guidance on decision-making involving environmental, social, and financial factors. Other topics addressed include sustainability, environmental justice, risk-benefit analysis, collaborations vs. privatization, and staff utilization.

### **CE 606 Artificial Intelligence Applications for Civil Engineers**

The course is designed to equip students with comprehensive knowledge and practical skills in harnessing the power of artificial intelligence (AI) technologies to solve complex problems and optimize various aspects of civil engineering projects. With the growing importance of AI in transforming traditional engineering practices, this course focuses on introducing students to cutting-edge AI techniques and their applications in the civil engineering domain.

### **CE 610 Structural Dynamics**

This course covers the analysis of the dynamic response of structures and structural components subjected to impact load, transient load, and ground excitations. Study single and multi-degree-of-freedom systems subjected to harmonic, impulsive, and arbitrary loads. Classical closed-form analytical solutions and approximate numerical solutions of the equations of motion will be considered for both linear and nonlinear structural systems. The solution in the frequency domain and the use of the finite element method. Advanced analysis techniques for discrete parameter systems; investigation of damping;



analysis of continuous systems. Spectral Analysis, elastic, and inelastic response spectra. Applications to civil engineering structures.

### **CE 611 Advanced Reinforced Concrete Design**

This course will cover the behavior and strength of reinforced concrete members under combined loadings, including creep, shrinkage, and temperature effects. Mechanisms of shear resistance and design procedures for the bond, shear, and diagonal tension. Elastic and ultimate strength analysis and design of slabs. Columns in multistory frames. Yield line theory of slabs; limit analysis of beams and frames of reinforced and pre-stressed concrete. Deflection and curvature of two-way edge supported and flat slabs, limit analysis, and design of beams and frames. Analysis and design of deep beams, brackets, corbels, bearing walls, shear walls, and beam-column joints. Applications to reinforced concrete structures.

### **CE 612 Finite Element Analysis**

This course covers the Basic principles and fundamental concepts of the finite element method. Elements used in the solution of two-and three-dimensional problems. Formulations for trusses, beams, and frames, plane stress problems, plane strain, axisymmetric and solid elastic elements, triangular and quadrilateral elements, isoparametric formulation and implementation, plate bending, and shell problems. The course considers geometric and material nonlinearities, convergence, mesh gradation, and computational procedures in analysis. Applications to plane stress and plane strain, plates and shells, eigenvalue problems, axisymmetric stress analysis, and other problems in civil engineering. Applications using commercial software packages.

### **CE 613 Advanced Structural Mechanics**

This course covers some advanced topics in the mechanics of solids. Stress and strain theory, inelastic material behavior, energy methods, torsion, nonsymmetrical bending of beams, shear center for thin wall beams, curved beams, flat plates, beams on elastic foundations, stress concentration. 3-D stress and strain analysis, failure theories, and stability of columns.

### **CE 614 Advanced Steel Structures**

This course will cover fundamental and advanced concepts in the design of steel buildings and bridges. Design of welded built-up plate girders, composite beams, and floor systems, simple shear and moment connections between steel beams and columns in frame systems. Design of bolted and welded connections, including moment-resistant connections, seated connections, and gusset-plate connections. Limit states/failure modes in steel components and structures, design and behavior considering residual stresses, lateral torsional buckling of beams, beams with web holes, web crippling, torsional design of beams, composite design of beams, design of multistory frames, plate buckling and plate girders, bracing requirements for compression members, and frame stability. Introduction to plastic design.

### **CE 615 Repair and Rehabilitation of Infrastructures**

This course focuses on the upkeep and restoration of existing infrastructures, covering serviceability requirements, mechanical loading, and environmental impacts. It delves into infrastructure deterioration, inspection procedures, and uses advanced analysis methods like finite element analysis and artificial intelligence. The course teaches various repair techniques for building envelopes, concrete, steel structures, and pavements. It explores modern monitoring methods such as laser techniques and fiber optics. Lastly, it provides insights on strengthening structures and different demolition techniques, offering a holistic view of infrastructure maintenance and rehabilitation.

### **CE 616 Sustainable Materials for Infrastructures**

The course offers an in-depth exploration of the critical role of materials in the design, construction, and maintenance of sustainable infrastructure systems. As global concerns about environmental impact and resource depletion grow, civil engineers need to adopt innovative and environmentally responsible approaches to infrastructure development. This master's level course focuses on introducing students to a wide range of sustainable materials, their properties, manufacturing processes, and their application in various infrastructure projects. Through theoretical lectures, hands-on experiments, and real-world case studies, students will gain comprehensive insights into selecting and utilizing sustainable materials that promote ecological balance, long-term durability, and social responsibility in civil engineering practices.

### **CE 617 Advanced Topics in Structural Engineering**

Advanced topics are selected from courses not offered in the student's curriculum and are in the field of Structural Engineering to suit the students' needs and backgrounds. This course must cover a new topic that is not introduced in the prescribed curriculum.

### **CE 620 Construction Law and Dispute Resolution**

This course covers the legal system and its impact on the construction process. The focus is on the construction company's legal obligations, rights, and remedies. Topics include bidding, contracts, and construction changes are designed to provide students with the opportunity to apply expert, specialized cognitive, and technical skills in a body of knowledge to compile and assess construction claims and avoid and resolve disputes through various dispute avoidance procedures and dispute resolution methods.

### **CE 621 Advanced Construction and Building Technology**

This course explores advanced construction and building technology, focusing on construction materials, concrete technology, composite materials, and the latest construction technologies. Students will understand the properties of various construction materials and how they are used in building structures. Topics covered include concrete technology, masonry, steel, timber structures, waterproofing and insulation materials, fire protection systems, and modern technologies such as Building Information Modeling (BIM). The course will also cover the latest developments in construction technology, such as 3D printing and robotics. Through lectures, discussions, case studies, laboratory experiments, and field trips to construction sites, students will understand the principles of advanced construction and building technology.

### **CE 622 Advanced Financial Management of Construction Projects**

This course covers several topics, including accounting, financial concepts, strategic analysis, and project finance, to help future construction leaders create enduring value. This course aims to educate, encourage, and excite future leaders in the engineering fields about basic accounting, finance, control, and strategic management principles that can lead to successful financial outcomes in competitive marketplaces. The course builds fundamental accounting principles early on and then moves into financial analysis and financial control before entering a study of strategic management. Strategic management builds on financial analysis and teaches students how to use business tools to evaluate business context: competitors, clients (customers), services (products), etc. A successful firm's elements will be covered in finance, human resources, information technology, products, and customer strategies. The course ends with a review of alternative project delivery methods and an introduction to project finance.

### **CE 623 Advanced Risk Management for Construction Projects**

This course focuses on identifying and managing risks at the level of construction projects, which may be a large architectural and engineering project, a civil infrastructure project, or even the creation of a new/innovative technology. This course discusses a set of ideas, tools and techniques used for risk analysis. This course introduces tools and techniques for decision-making under uncertainty, with a focus on constructed facilities and infrastructure projects. The course will focus largely on the early techniques of project delivery (i.e., the role of participants, contracting, contract design, project financing approaches, and risk allocation). This course also aims to identify and identify risks, evaluate alternative contracting and financing options, and find alternative solutions in emergency situations. The course will enable students to use risk identification techniques and decision theory to choose the optimal strategy and make decisions that suit the nature of the project.

### **CE 624 Advanced Quality Systems in Construction Projects**

This course represents quality knowledge and quality improvement methods, Quality standards, Quality needs, and overall strategic plans, customer satisfaction and focus, tools for Quality Project Management, Statistical process control, tools for continuous improvement, recent developments in Quality in Constructed projects, ISO standards, the survey of computer application software related to quality management.

### **CE 625 Advanced Construction Equipment Management**

This course will provide a detailed overview of construction equipment and its use. Students will gain an understanding of the types of construction equipment. In addition, construction equipment operations and management, as well as decision-making related to construction equipment management, will be covered. Students will also gain knowledge of work process modeling and simulation tools. Topics covered will include techniques for estimating equipment ownership and operating costs, site work estimating and scheduling using equipment productivity and cost data, types of equipment, and techniques for estimating equipment productivity. Finally, an overview of major

equipment management issues will be presented. The objective of this course is to learn about construction equipment, its use, and its management.

### **CE 626 Sustainable Construction Techniques**

This course will introduce students to the principles and practices of sustainable construction techniques. Students will learn how to design and manage construction projects with the aim of minimizing environmental impact, optimizing building performance, and creating healthier living and working environments. Topics to be covered include sustainable building materials, energy-efficient design, waste and water management, and green certification systems. Students will engage in practical exercises and case study analysis to understand how these techniques are applied in real-world contexts.

### **CE 627 Environmental Impact Assessment and Risk Analysis**

In this course, students will learn methodologies for assessing the environmental impact of infrastructure projects and develop skills in identifying and mitigating environmental risks. Topics include an Introduction to environmental law, local, regional, and international requirements; Environmental planning and policy; Introduction to risk analysis-human and environmental health; Concept of the environment and project impacts; Environmental quality and pollution; Framework for Environmental Impact Assessment (EIA); Impact assessment and analysis; The EIA process: Screening, Scoping, impact prediction, Mitigation measures; preparing EIA reports; EIA and decision making; Practical examples and case studies.

### **CE 628 Advanced Topics in Construction Project Management**

Advanced topics are selected from courses not offered in the student's curriculum and are in the field of construction project management to suit the students' needs and backgrounds. This course must cover a new topic that is not introduced in the prescribed curriculum.

### **CE 630 Advanced Soil Mechanics**

This course is designed to provide advanced theoretical background for analyzing the deformation and failure of soils. These include stresses and strains in soil, stress path, failure theory and shear strength, elasticity, theory of plasticity, critical state model, shear strength of partially saturated soils, time-dependent behavior of clay, and stability of slopes.

### **CE 631 Advanced Foundation Engineering**

Review of subsurface exploration, evaluation, and design of shallow foundations, including settlement and bearing capacity of spread footings and mats. Methods of soil improvements in foundation design, Shoring and underpinning, box foundations, machine foundations, foundations on difficult grounds, and special foundations use computer software for analysis and design.

### **CE 632 Behavior and Design of Deep Foundations**

This course covers Types of piles and classification, piling equipment and methods, evaluating the resistance of piles and pile groups to compression loading, design of pile foundations to resist uplift and lateral loading, Piling for marine structures, structural design of piles and pile groups, various piling problems, site investigation, and pile testing, and computer applications.

#### **CE 640 Traffic Operations and Flow Theory**

Studies of space and time distribution of speed and other traffic characteristics in the transportation network. Macro, micro, and mesoscopic traffic flow theories. Simulation in traffic networks. Application of flow theories to traffic control and operations.

#### **CE 641 Pavement Management Systems**

This is an advanced course designed to provide students with a comprehensive understanding of the theories and practices of pavement management systems and their applications in civil engineering. The course begins with an overview of the history of pavement management systems and the current state-of-the-art in this field. It then covers the fundamental concepts of pavement mechanics, including the behavior of asphalt and concrete pavements under loads and environmental conditions. Students will also learn about the types of pavement distress and how to evaluate and measure these types of distress. The course will then focus on the various tools and techniques used in pavement management systems, including asset management, condition assessment, and life-cycle cost analysis. Students will learn how to apply these tools and techniques to prioritize and plan road maintenance and rehabilitation activities based on the condition of the pavement and available resources.

#### **CE 642 Advanced Pavement Analysis and Design**

Historical developments, road tests, design factors, stresses and strains in flexible pavements, stresses and strains in rigid pavements, traffic loading and volume, pavement performance, reliability methods, pavement design methods, design of pavement shoulders, and computer applications.

#### **CE 650 Advanced GIS and Remote Sensing**

This course provides advanced topics in GIS and geospatial technology, with a focus upon advanced spatial analysis methods such as network analysis, cost distance analysis, site selection and optimization, interpolation, multi-layer raster data analysis (map algebra), and other related techniques. Also, it introduces the Fundamentals of remote sensing and image processing.

#### **CE 651 Advanced Surface Water Hydrology**

This course provides students with an advanced body of knowledge in surface water hydrology. Topics important to civil and Environmental Engineering will be covered, including Hydrologic Cycle, Rainfall-Runoff analysis, Stream flow measurement, floodplain hydraulics, Unit hydrograph analysis, Water quality in engineered and natural systems, Advanced hydrologic analysis methods (statistics, probability, and time series

analysis), computer models in surface hydrology and their applications, and concept of integrated water cycle management

### **CE 652 Waste-to-Energy and Materials Recovery**

This course introduces the fundamentals of waste-to-energy conversion and material recovery. The covered waste-to-energy processes include bioreactor landfills, anaerobic digestion, incineration, gasification, pyrolysis, and other state-of-the-art methods. The potential hazards/uses of by-products, economics, and social implications of those technologies are discussed. The course also covers various material recovery processes and recycling opportunities & challenges.

### **CE 653 Sustainable Urban Water Engineering**

The course aims at providing students with an advanced understanding of urban water and the importance of considering contamination for planning, development, and operation of infrastructure. This course covers an Introduction to the urban water cycle and descriptions of how the development of infrastructure and construction works affects the flows and water quality in urban areas; Legislation and regulations such as the Water Framework Directive, water quality standards, and guidelines; Important key concepts: remedial and preventive actions, sustainable development, sustainable urban drainage systems (SUDS), removal processes, design criteria, and Planning and decision-making tools for sustainable water management.

### **CE 699 Master Thesis**

A Master's thesis should demonstrate the student's ability to complete a full cycle of problem formulation, methodology, research, and evaluation under the direction of the student's graduate faculty committee. Upon completing the thesis, the student must satisfactorily defend it as part of a comprehensive examination given by the graduate faculty committee that has an external examiner. The graduate faculty committee evaluates the student's performance on the examination and reports to the college of Graduate Studies and Scientific Research. The Master's Thesis defense is open to the public.

**Sixth: Capabilities available in the Civil Engineering Department:**

Name	Education		Academic Rank	Specialization
	University	Year		
<b>Prof. Hashem Al-Mattarneh</b>	Universiti Kebangsaan Malaysia, Malaysia.	2005	Professor	Structural Engineering
<b>Prof. Aiman Jaradat</b>	Clarkson University, USA.	2008	Professor	Water and Environmental Engineering
<b>Dr. Madhar Taamneh</b>	Akron University, Ohio, USA.	2009	Associate Professor	Transportation Engineering
<b>Dr. Faisal Shlabi</b>	University of Illinois Urbana-Champaign, USA.	2000	Associate Professor	Geotechnical Engineering
<b>Dr. Randa Hatamleh</b>	New Mexico State University, USA.	2011	Associate Professor	Water Resources and Sustainability Engineering
<b>Dr. Ahmad Alomari</b>	University of Central Florida, USA.	2015	Associate Professor	Sustainable Transportation Engineering
<b>Dr. Faris Matalkah</b>	Michigan State University, USA.	2017	Associate Professor	Structural Engineering
<b>Dr. Walid Edris</b>	Castilla- La Mancha, Spain.	2013	Associate Professor	Structural Engineering
<b>Dr. Yaser Jaradat</b>	University of Maryland-College Park, USA.	2005	Assistant Professor	Structural Engineering
<b>Dr. Ahmad Altarabsheh</b>	Purdue University, USA.	2016	Assistant Professor	Construction Engineering and Management
<b>Dr. Mohanad Khodier</b>	Utah State University, USA.	2014	Assistant Professor	Water Resources and Environmental Engineering
<b>Dr. Ahmed Salama</b>	Al-Azhar University, Egypt.	2014	Assistant Professor	Structural Engineering
<b>Dr. Musab Abuaddous</b>	Marche Polytechnic University, Italy.	2016	Assistant Professor	Transportation Engineering
<b>Dr. Dua'a Telfah</b>	University of Genoa, Italy, 2018	2018	Assistant Professor	Water Resources and Environmental Engineering
<b>Dr. Ali Shehadeh</b>	University of Central Florida, USA.	2019	Assistant Professor	Construction Engineering and Management
<b>Dr. Hamsa Nimer</b>	Northeastern University, USA.	2020	Assistant Professor	Construction Engineering and Management
<b>Dr. Ammar Alshonaq</b>	Georgia Institute of Technology, USA.	2022	Assistant Professor	Structural Engineering
<b>Dr. Muath Abu</b>	Lehigh University, USA.	2022	Assistant	Geotechnical

Name	Education		Academic Rank	Specialization
	University	Year		
<b>Qamar</b>			Professor	Engineering
<b>Dr. Mohammad Firas Altamimi</b>	Oklahoma State University	2022	Assistant Professor	Structural Engineering
<b>Walaa Darweesh</b>	MS degree from Jordan University of Science and Technology, Jordan.	2014	Lecturer	Transportation Engineering
<b>Heba AL-Jabaly</b>	MS degree from the University of Jordan, Jordan.	2014	Lecturer	Structural Engineering
<b>Suzan Alateek</b>	MS degree from Kennesaw State University, USA.	2012	Lecturer	Construction Engineering and Management
<b>Suhaib Fareed Alfaris</b>	Texas A&M University	2024	Assistant Professor	Structural Engineering
<b>Moataz Mohammad Mohammad</b>	QS Rank: 168	2023	Assistant Professor	Structural Engineering

**Seventh: Faculty Members involved in the program:**

Name	Education		Academic Rank	Specialization
	University	Year		
<b>Prof. Hashem Al-Mattarneh</b>	Universiti Kebangsaan Malaysia, Malaysia.	2005	Professor	Structural Engineering
<b>Prof. Aiman Jaradat</b>	Clarkson University, USA.	2008	Professor	Water and Environmental Engineering
<b>Dr. Madhar Taamneh</b>	Akron University, Ohio, USA.	2009	Associate Professor	Transportation Engineering
<b>Dr. Faisal Shlabi</b>	University of Illinois Urbana-Champaign, USA.	2000	Associate Professor	Geotechnical Engineering
<b>Dr. Randa Hatamleh</b>	New Mexico State University, USA.	2011	Associate Professor	Water Resources and Sustainability Engineering
<b>Dr. Ahmad Alomari</b>	University of Central Florida, USA.	2015	Associate Professor	Sustainable Transportation Engineering
<b>Dr. Faris Matalkah</b>	Michigan State University, USA.	2017	Associate Professor	Structural Engineering
<b>Dr. Walid Edris</b>	Castilla- La Mancha, Spain.	2013	Associate Professor	Structural Engineering
<b>Dr. Yaser Jaradat</b>	University of Maryland-College Park, USA.	2005	Assistant Professor	Structural Engineering
<b>Dr. Ahmad</b>	Purdue University,	2016	Assistant	Construction



Name	Education		Academic Rank	Specialization
	University	Year		
<b>Altarabsheh</b>	USA.		Professor	Engineering and Management
<b>Dr. Mohanad Khodier</b>	Utah State University, USA.	2014	Assistant Professor	Water Resources and Environmental Engineering
<b>Dr. Ahmed Salama</b>	Al-Azhar University, Egypt.	2014	Assistant Professor	Structural Engineering
<b>Dr. Musab Abuaddous</b>	Marche Polytechnic University, Italy.	2016	Assistant Professor	Transportation Engineering
<b>Dr. Dua'a Telfah</b>	University of Genoa, Italy, 2018	2018	Assistant Professor	Water Resources and Environmental Engineering
<b>Dr. Ali Shehadeh</b>	University of Central Florida, USA.	2019	Assistant Professor	Construction Engineering and Management
<b>Dr. Hamsa Nimer</b>	Northeastern University, USA.	2020	Assistant Professor	Construction Engineering and Management
<b>Dr. Ammar Alshonaq</b>	Georgia Institute of Technology, USA.	2022	Assistant Professor	Structural Engineering
<b>Dr. Muath Abu Qamar</b>	Lehigh University, USA.	2022	Assistant Professor	Geotechnical Engineering
<b>Dr. Mohammad Firas Altamimi</b>	Oklahoma State University	2022	Assistant Professor	Structural Engineering
<b>Suhaib Fareed Alfaris</b>	Texas A&M University	2024	Assistant Professor	Structural Engineering
<b>Moataz Mohammad Mohammad</b>	QS Rank: 168	2023	Assistant Professor	Structural Engineering