

# The Hashemite University

Faculty of Engineering

Department of Civil Engineering

## Study Plan for MSc degree in Structural Engineering (Comprehensive)

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### **Introduction:**

The structural engineering is that science that deals with the application of the basics of the civil engineering in the design and supervision of different structures, such as concrete and steel buildings, bridges, hydraulic structures, and dams.

### **First: Program Goals**

1. Supply the industry sector with qualified engineers who are specified in structural engineering and its different applications to design and supervise different structures and to be capable of applying research and improvements in this field.
2. Help in finding solutions for problems in construction and economical solutions for the high prices of the residential buildings in the kingdom by elaborating and conducting research and studies to train engineers on the advance programs that are connected to structures.

### **Second: Program Justifications**

1. The ministry of public works and housings requires designing and analyzing the structures for earthquake loads. Based on that, this program will attain the chances for the engineers to design and analyze the structures to resist the earthquake loads.
2. The kingdom suffers from many failures in the structures due to excessive loading. Many steel structures had failed due to unexpected environmental and weathering issues such as snow and etc.
3. Help the industry especially the housing sector by introducing training course, providing engineering consultations, studies, research, and providing them with qualified people.
4. Performing research in different fields of structural engineering.
5. The availability of research tools in the Civil Engineering Department in the Hashemite University by having the Structural Systems Laboratory that is considered number one in the Kingdom also the region and it can be compared to the top universities in the USA. This Laboratory has all the needed instruments that will help the community to find the updated Structural Solutions.

### **Third: General Condition:**

1. This plan is prepared according to the instructions and requirements of the Faculty of Graduate Studies at the Hashemite University.
2. Applicants must hold a BSc. in Civil Engineering.

**Fourth: Special Requirements:**

All students applying for admission to the MSc. degree must pass the English Proficiency test prepared by the Ministry of Higher Education. The student can take the exam during or before enrollment into the program.

**Fifth: Prerequisite course:**

Are determined on individual student basis and in accordance with article (6) of the MSc. degree instructions, No. (2), 1998.

**Sixth: The Degree Plan Consist of :**

**1- Compulsory Courses Fifteen (16) credit hours as follows:-**

Course Number	Course Title	Credit Hours	Prerequisite
190401701	Finite Element Method in Structural Engineering	3	-
190401702	Plastic Behavior and Design of Steel Structures	3	-
190401703	Advanced Structural Dynamics	3	-
190401704	Advanced Theory of Concrete Structures	3	-
190401705	Earthquake Structural Engineering	3	190401703
190401797	Seminar	1	

**2- Elective Courses: Eighteen (18) credit hours selected from the following list:**

Course Number	Course Title	Credit Hours	Prerequisite
190401706	Advanced Numerical Analysis	3	-
190401707	Theory of Plates and Shells	3	-
190401708	Theory of Elasticity	3	-
190401709	Geotechnical Aspects of Earthquake Engineering	3	-
190401710	Structural Stability	3	-
190401711	Bridge Engineering	3	-
190401712	Advanced Foundation Engineering	3	-
190401713	Composite Structures	3	-
190401714	Advanced Concrete Technology and Materials	3	-
190401715	Advanced Special Topics in Civil Engineering	3	-

**3. A Comprehensive Exam (190401798).**

## Seventh: Course Description

### **(190401701) Finite Element Method in Structural Engineering, 3 Cr. Hrs (3+0).**

Theory of finite element, virtual work, formulation for trusses, beams and frames, plane stress problems, plane strain, axisymmetric and solid elastic elements, isoparametric formulation and implementation, plate and shell elements, application of the method using ready software packages.

### **(190401702) Plastic Behavior and Design of Steel Structures, 3 Cr. Hrs (3+0).**

General concepts of plasticity; plastic bending; collapse of structures; lower and upper bound theorems; limit analysis; deflection, rotation capacity; joint behavior; plastic design of multi-story structures; seismic requirements in steel structures.

### **(190401703) Advanced Structural Dynamics, 3 Cr. Hrs (3+0).**

Analysis of single and multi-degree-of-freedom structures subjected to various types of excitations and initial conditions; computational aspects of dynamic analysis; introduction to approximate methods of analysis; finite element formulation of equations of motion; advanced analysis techniques for discrete parameter systems; investigation of damping; analysis of continuous systems; applications to civil engineering structures.

### **(190401704) Advanced Theory of Concrete Structures, 3 Cr. Hrs (3+0).**

Inelastic theory of structural concrete members under flexure; axial load; combined flexure and axial compression; shear and torsion; yield line theory of slabs; limit analysis of beams and frames of reinforced and pre-stressed concrete.

### **(190401705) Earthquake Structural Engineering, 3 Cr. Hrs (3+0).**

#### **Prerequisite (190401703)**

Effects of earthquakes on structures and of design of structures to resist earthquake motions; earthquake mechanisms and ground motions; response of structures to earthquake motions; behavior of materials, structural elements and assemblages subjected to earthquakes; principles of earthquake-resistant design practice; soil-structure interaction; and special topics.

### **(190401706) Advanced Numerical Analysis, 3 Cr. Hrs (3+0).**

Computer precision, loss of significance; error propagation; linear and nonlinear systems of algebraic equations; interpolating polynomials; numerical differentiation and integration; numerical solution of ordinary differential and partial-differential equations; initial and boundary value problems; linear and nonlinear systems; approximation theory; iterative techniques (Eigen values); finite differences; boundary integral equation; Fourier approximations.

**(190401707) Theory of Plates and Shells, 3 Cr. Hrs (3+0), .**

Bending theory of rectangular and circular thin plates; approximate methods of plate analysis, plates on elastic foundation; introduction to shell theories, Membrane theory of shells of revolution; bending theory of shell of revolution loaded axi-symmetrically; membrane theory of cylindrical shells; approximate bending methods for any type of shells of revolution; analysis of shallow spherical shells.

**(190401708) Theory of Elasticity, 3 Cr. Hrs (3+0).**

Equations of equilibrium and compatibility; stresses and strains in beams; flexure and torsion theories for solid and thin-walled members; Energy principles and variational methods.

**(190401709) Geotechnical Aspects of Earthquake Engineering, 3 Cr. Hrs (3+0).**

Overview of Earthquake Engineering; ground motion parameters; seismic Hazard Analysis; determining seismic design parameters; dynamic soil properties; ground response analysis; evaluation of liquefaction hazard; seismic design of foundations (Shallow and Deep); seismic design of retaining walls; seismic slope stability; ground improvement for redemption of seismic hazards.

**(190401710) Structural Stability, 3 Cr. Hrs (3+0).**

Equilibrium paths and critical point, Bending of structural members subjected to axial and lateral loads. Buckling of compression members (columns) and frames in elastic range, lateral buckling of beams, Buckling of Plates.

**(190401711) Bridge Engineering, 3 Cr. Hrs (3+0).**

Classification of bridges superstructures and substructures; bridge loadings according to AASHTO standards and other standards; transfer and longitudinal distribution; modeling and analysis of bridge decks; orthotropic plate theory and its application; composite bridges; girder slab and multi-beam types pre-stressed concrete bridges; design of reinforced and pre-stressed concrete bridges; bearing systems; software applications in bridge analysis.

**(190401712) Advanced Foundation Engineering, 3 Cr. Hrs (3+0).**

Site investigation, general concept of foundation design, foundation design in relation to ground movement, spread foundations, control of groundwater in excavations, shoring and underpinning, foundation construction, structural aspects in the design of foundations, foundations on difficult soils, foundation remediation, behavior of deep foundation under axial and horizontal loading, grouped piles, deep foundation field tests, installation, inspection, and settlement.

**(190401713) Composite Structures, 3 Cr. Hrs (3+0).**

Design and behavior of steel under tensile and compressive loading, bending and lateral buckling of beams, torsion in beams, beam - columns, buckling of plates, composite construction, design and behavior of composite beams and columns and beam –columns.

**(190401714) Advanced Concrete Technology and Materials, 3 Cr. Hrs (3+0).**

Hydration and pore structure; uni-, bi- and tri-axial strength; special concretes and materials (properties and mix design): no slump concrete; roller compacted concrete; mass concrete; high-strength and ultra-high strength concrete; lightweight concrete; self-compacting concrete; pumped concrete; shotcrete.

**(190401715) Special Topics in Civil Engineering, 3 Cr. Hrs (3+0).**

A course to be given at the discretion of the faculty in which topics of current interest in civil engineering will be presented.

**(190401797) Seminar, 1 Cr. Hrs (1+0).**

Research presentations.

**(190401798) Comprehensive Exam.**