| **Brief Course Description - Course Plan Development and Updating Procedures**<br>Department of Civil and Infrastructure Engineering | **QF09/0409-3.0E** |
|---|---|

| | | | | |
|---|---|---|---|---|
| Faculty | Faculty of Engineering and Technology | Academic Department | **Civil and Infrastructure Engineering** | Number of the course plan **(2023-1)** |
| Number of Major requirement courses | **50** | Date of plan approval | **28/11/2023** | Version (7) |

## Major Mandatory Requirements

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908203** | **3** | **Strength of Materials** | **Statics** |
| Stress and strain, mechanical properties of materials, Hook's Law, stress and strain under axial loading, thermal stresses, torsion, analysis and design of beams, stresses and strains under the influence of bending, composite sections, combined stresses, plane stresses and strains and analysis, buckling of columns. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908204** | **1** | **Strength of Materials Laboratory** | **Co. Strength of Materials** |
| Tension test, torsion test, deflection of beams, creep test, hardness test, fatigue test, and thin cylinder test, buckling of columns, impact test. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908205** | **3** | **Probability and Statistics for Engineers** | **Calculus I for Engineering Students** |
| Counting rules, conditional and independent probabilities, random variables, discrete and continuous densities and distribution functions, exponential, standardizing, statistical sample distribution parameters, Gaussian, Binomial, Poisson and hyper-geometric distributions, central limit theorem, statistical estimation, hypothesis testing, statistical tests, mean and sample proportion for small and large samples, method of least squares correlation and regression. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908206** | **3** | **Statics** | **General Physics I** |
| Force vectors and resultant. Free-body diagram of forces and equilibrium of particles and rigid bodies. Moment of a force about a point and about an axis. Analysis of trusses and frames. Shear force and bending moment diagrams. Centroids and moment of inertia of an area. | | | |

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| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908207** | **3** | **Dynamics** | **Statics** |
| Kinematics of particles: rectilinear continuous and erratic motion, general curvilinear motion and its components; translating and rotating coordinate systems; Kinetics of particles: force-acceleration, Newton's Laws of Motion, equations of motion, principle of work and energy, linear momentum and angular momentum; planar kinematics of rigid bodies: rigid body motion, translation and rotation, relative motion analysis, acceleration; introduction to structural dynamics. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908221** | **3** | **Engineering Geology** | **General Chemistry for Engineering Students** |
| Silicate minerals and non-silicate minerals, physical properties of minerals, rock types and their formation, engineering properties of rocks, as construction materials, topographic maps, plate tectonics, earthquakes and earth movements, landslides, subsidence, liquefaction, eras, faults and types of faults and folding, subsurface exploration. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908224** | **3** | **Engineering Geology Laboratory** | **Co. Engineering Geology** |
| Determination of the water content and density of rocks and soils; Absorption and specific gravity of rocks and soils; Particle size analysis (mechanical method); Compressive strength of rock cores; Rock Quality Designation-RQD; Physical properties of minerals (color, streak, cleavage, fracture, hardness and specific gravity); Descriptions and identifying characteristics of different types of rocks (Igneous, Sedimentary and Metamorphic Rocks); Effect of acid reacting with calcite; Geological and topographic map, Introducing the geological featurism map scale. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908310** | **3** | **Applied Mathematics** | **Linear Algebra** |
| This course focuses on a variety of mathematical topics and its engineering applications. The student will be introduced to important mathematical concepts such as: complex numbers; linear algebra; calculus; matrix analysis; vector analysis; Cartesian, spherical, and cylindrical coordinates. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908311** | **1** | **Applied Mathematics Laboratory** | **Co. Applied Mathematics** |
| The application of computer software in solving problems related to topics of applied mathematics in the area of civil engineering such as: complex numbers; linear algebra; calculus; matrix analysis; vector analysis; Cartesian, spherical, and cylindrical coordinates. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908326** | **2** | **Material Science** | **Engineering Geology** |
| Understanding the structure of materials in term of crystal geometry, structural disorder, and solid solution and phase diagram. Material classification: metals, polymers, ceramics, glass, and composites. Material properties (mechanical, thermal, chemical, optical, and electrical). | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908327** | **3** | **Concrete Technology** | **Material Science** |
| Aggregates: properties and tests. Cement: properties, manufacturing, hydration, types and tests. Mixing water: properties and tests. Fresh concrete: workability, segregation, mixing, and tests. Hardened concrete: strength of concrete, durability and tests. Concrete mix design, concrete blocks and admixtures. Computer applications and case studies. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908328** | **1** | **Concrete Technology Laboratory** | **Co. Concrete Technology** |
| Aggregate tests: sieve analysis, specific gravity, unit weight, abrasion, strength, impact. Cement tests: normal consistency, setting time. Mortar tests: flowability, strength. fresh concrete tests: workability, strength. Destructive and non-destructive hardened concrete, brick tests, steel tests, concrete mix design. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908331** | **3** | **Structural Analysis** | **Strength of Materials** |
| Classifications of structures, loads on structures, static determinacy and indeterminacy, external and internal instability, equilibrium and support reactions, principle of superposition, analysis of plane and space trusses, analysis of beams and frames, shear, bending moment and qualitative deflected shape, deflection of beams and frames by geometric and energy methods, deflection of trusses by virtual work method, influence lines for beams, frames and trusses by equilibrium method, application of influence lines. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908337** | **3** | **Fluid Mechanics for Civil Engineering** | **Statics** |
| Fluid properties and definitions. Hydrostatics and stability of floating bodies. Fluid flow, energy and continuity relationships. Force and momentum relationship. Dimensional analysis and similarity. Flow in conduits, laminar and turbulent flows, frictional and minor losses, piping systems. Introduction to turbomachinery. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908341** | **3** | **Surveying** | **Calculus I** |
| Principles of surveying, units of measurements, plotting scale and map scale, linear measurements, leveling, directions (measurement of angles and its tools), plane coordinates system, contour lines, traversing, errors and adjustments, areas and volumes, introduction to GIS. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908342** | **1** | **Surveying Laboratory** | **Co. Surveying** |
| Surveying equipment, pacing and taping, leveling, differential leveling, measurement of horizontal angles, measurement of vertical angles, traverse layout, contour lines, topographic mapping, and total station. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908345** | **3** | **Linear Algebra** | **Calculus I** |
| Matrices and vectors, operations on matrices, determinants, system of linear equations and methods for solving them, vectors in spaces, linearly dependent and independent, linear transformations, kernel and span, Eigen values and Eigen vectors, applications in civil engineering. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908353** | **3** | **Hydraulics** | **Fluid Mechanics for Civil Engineering** |
| Basic principles of hydraulic engineering, hydraulics of pipe networks, water hammer. Flow in open channels: uniform and non-uniform flows and flow measurement devices. Hydraulics machines: pumps and turbines. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908356** | **1** | **Water and Environment Laboratory** | **Co. Water and Environmental Engineering** |
| Properties of fluids, hydrostatic principles, open channel flow, pipe losses, pumps, flocculation and coagulation, conductivity test, turbidity test , biochemical oxygen demand (BOD), chemical oxygen demand (COD), residual chlorine, chloride, acidity, alkalinity. | | | |

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| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908359** | **3** | **CAD in Civil Engineering** | **Engineering Drawing** |
| Basic principles of engineering drawing and interactive computer graphics, computer-aided drafting, 2- and 3D modeling, descriptive geometry and visualization in modern CAD systems, use of modern CAD platforms as design tools in civil and infrastructure engineering applications. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908361** | **3** | **Geotechnical Engineering** | **Strength of Materials** |
| Formation, composition and structure of soils, index properties of soils, soil classification, soil compaction, flow in porous media, one dimensional and two dimensional flows. Soil stresses: geostatic and effective stresses. Distribution of stresses due to surface applied loads, consolidation theory and time-rate of consolidation, shear strength of soils and shear strength tests. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908362** | **1** | **Geotechnical Engineering Laboratory** | **Co. Geotechnical Engineering** |
| Visual classification of soil, moisture content, organic content, sieve analysis, hydrometer test, Atterberg limits, compaction, in-situ field density, permeability, consolidation, direct shear test, tri-axial test. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908401** | **3** | **Engineering Practical Training** | **Passing 115 Credits for 8 weeks (280 Hrs.)** |
| The student has to spend at least 280 hours of civil engineering training at recognized companies and establishments during one semester. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908433** | **3** | **Reinforced Concrete I** | **Structural Analysis I** |
| Flexural analysis and design of beams: singly reinforced rectangular beams, doubly reinforced rectangular beams, T-beams, shear and diagonal tension, bond, anchorage and development length, analysis and design of one-way slabs, design of compression members. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908434** | **3** | **Reinforced Concrete II** | **Reinforced Concrete I** |
| Analysis and design of RC columns; analysis and design of shallow foundations; analysis and design of torsion in beams; analysis and design of two-way slabs; analysis and design of staircases. | | | |

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| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908435** | **3** | **Steel Structures Design** | **Structural Analysis** |
| Fundamentals of steel structures, design of tension members, design of compression members, design of beams, design of beam-columns, and design of connections. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908441** | **3** | **Traffic and Transportation Engineering** | **Surveying** |
| Concepts, fundamental parameters of traffic engineering, fundamentals of transportation engineering, basics of highway capacity and level of service, traffic control devices, basics of highway safety, introduction to the application of supervised and unsupervised machine learning for predicting traffic and accident patterns. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908454** | **3** | **Engineering Hydrology** | **Hydraulics** |
| Hydrologic cycle and hydrological processes: precipitation, evaporation, infiltration, and generation of surface runoff, rainfall-runoff analysis and synthetic flood hydrograph. Groundwater hydrology and wells hydraulics, statistical hydrology, hydrologic analysis and design. Computer and AI applications. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908457** | **3** | **Water and Environmental Engineering** | **Hydraulics** |
| Drinking water engineering: water demand estimation, design period, population estimation, sources of water, physical, chemical, and biological quality of water. Drinking water treatment: coagulation, flocculation, sedimentation, filtration, disinfection, and softening. Removal of taste and odor. Flow in pipes and analysis of water distribution networks. Computer applications. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908462** | **3** | **Foundation Engineering** | **Geotechnical Engineering** |
| Review of rock types and origin of soil, review of soil mechanics, subsoil exploration (site investigation), shallow foundations, bearing capacity, special cases in foundation design, foundation design on rocks, foundation settlement (elastic and consolidation), lateral earth pressure, retaining walls, deep foundations. | | | |

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| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908501** | **1** | **Graduation Project I** | **Passing Engineering Practical Training** |
| A supervised project in groups of normally three to five students aimed at providing practical experience in some aspect of civil and infrastructure engineering. Students are expected to complete a literature survey, project specification, critical analysis, and to acquire the necessary material needed for their intended end product. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908502** | **2** | **Graduation Project II** | **Graduation Project I** |
| This is a continuity of the final Graduation Project I, consequently the students are expected to successfully accomplish the final year project in the specified field of Graduation Project I. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908547** | **3** | **Highway and Pavement Design** | **Traffic and Transportation Engineering** |
| Horizontal and vertical alignment, cross section elements and super-elevation, pavement types and structural design, stress and strain calculations, design of flexible pavements, pavement materials, physical properties and tests, volumetric analysis and design of asphalt mixes using Marshall's method. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908548** | **1** | **Highway and Pavement Laboratory** | **Co. Highway and Pavement Design** |
| Sieve analysis of coarse aggregates, coarse and fine aggregates tests: specific gravity and absorption, asphalt cement: ductility, penetration, softening point, flash and fire point, viscosity, Hot Mix Asphalt (HMA) design by Marshall skid resistance, asphalt extraction from cores. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908571** | **3** | **Specifications and Quantity Survey** | **Reinforced Concrete I** |
| Introduction to specifications, contracts and quantity survey, types of construction contracts and their obligations to project parties (FIDIC), building items, general and particular technical specifications of building items, preparation of engineering quantity surveying. | | | |

## Courses taught to the department and other departments in the faculty

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| 0908201 | 2 | Technical Writing and Professional Ethics | Communication skills in English |
| Practice in writing technical reports, resume, presentation of technical data, effective communication, introduction to engineering ethics, professionalism and codes of ethics, rights and responsibilities of engineers, risks safety and accidents. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| 0908461 | 3 | Projects Management and Value Engineering | Engineering Economics |
| Principles and characteristics of engineering project management, business management and organization structure, introduction to value engineering, leadership principles and professional licensure, contract administration, cost management, project planning and scheduling (manually and using software), resource allocation and leveling, delay and claims, risk management. | | | |

## Major Elective Requirements

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| 0908503 | 3 | Special Topics | Project Management and Value Engineering |
| Vary with nature of selected topic that is of special interest to undergraduates. May be repeated for maximum 6 credits if topics are substantially different, which is subjected to departmental approval. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| 0908523 | 3 | Infrastructure Systems | Project Management and Value Engineering |
| Introduction to infrastructure systems, including energy systems, water and wastewater infrastructure, transportation systems, waste disposal, and resource conservation. The stages of an infrastructure project lifecycle. Infrastructure sustainability including social, economic and environmental aspects. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| 0908533 | 3 | Pre-Stressed Concrete | Reinforced Concrete I |
| Basic principles, short- and long-term properties of constituent materials, partial pre-stressing. Flexural behavior, analysis and design of pre-stressed concrete beams, classes, cracking, pre-tensioning, post-tensioning, service load design, load balancing, strength design, strain limits, flexural efficiency, Bond, transfer and development lengths, anchorage zone design, Shear and diagonal tension, Evaluation of immediate and long-term losses, Composite construction and design, shear-friction theory, Deflection calculation using approximate single time step approach. | | | |

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| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908535** | **3** | **Flood Risk Management** | **Engineering Hydrology** |
| Introduction to flood risk, flood probability and the consequences of the flood. Estimation of runoff flood peak-flow, design flood probability and return period. Engineering structural and non-structural measures to reduce and mitigate flood risk. Flood protection structures and detention ponds, flood routing. Flood early warning and response systems. Economic, environmental and social aspects in managing flood risk. Computer applications and case studies. | | | |

| Course number | Credit hours | Title of the course | Prerequisite |
|---|---|---|---|
| **0908539** | **3** | **Introduction to Earthquake Engineering** | **Reinforced Concrete I** |
| Origin and characteristics of earthquake, structural dynamics; vibration characteristics of building, periods and mode shapes, response spectrum, earthquake-induced forces and displacements, inelastic behavior, force reduction and ductility requirements for concrete and steel material, Jordanian seismic code and international building seismic codes, seismic design and provisions of reinforced concrete frames and shear walls according to ACI code. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908545** | **3** | **Highway Maintenance** | **0908547** |
| Management procedures for highway maintenance projects: project level and network level, paved networks and their branches, sections and sample units to prioritize and manage maintenance and rehabilitation processes, distress survey of paved areas, Pavement Condition Index scoring method, overview of maintenance and rehabilitation methods. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908552** | **3** | **Water and Wastewater Network Design** | **0908452** |
| Application of fundamental engineering science to the design of comprehensive water supply and sewer systems. Design criteria, Water demand for domestic and industrial water supplies. Pipe networks, water distribution system design. Waste and storm water networks design. Computer applications. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908563** | **3** | **Advanced Geotechnical Engineering** | **Geotechnical Engineering** |
| Soil exploration, shear strength theory and testing, lateral earth pressure theory, external stability analysis of retaining structures, fundamentals of geo-synthetic reinforced retaining structures, slope stability analysis, problematic soil, soil improvement techniques, deep foundations, introduction to soil dynamics. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908586** | **3** | **Building Maintenance** | **Reinforced Concrete I** |
| Investigation of the natural and industrial environmental factors that lead to damage of construction elements, effective detection and maintenance plans, techniques and materials for maintenance, preventive methods, repair and replacement techniques, non-destructive testing techniques, field application and case studies. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908587** | **3** | **Geographic Information System (GIS)** | **Surveying** |
| GIS basics, introduction to ArcGIS, exploring the data structure for ArcGIS, working with tabular data, managing map layers, working with coordinate systems, and GIS applications in civil engineering. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908588** | **3** | **Advanced Construction Management** | **Project Management and Value Engineering** |
| Project management in the context of construction projects. Characteristics and phases of construction projects, planning and procurement of materials and equipment, planning of operations and processes, productivity and resource use, project key performance indicators, and project control, and different types of communications such as project logs, reports, submittals, meetings, and close out. | | | |

| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908589** | **3** | **Intelligent Transportation System (ITS)** | **Traffic and Transportation Engineering** |
| Basics of intelligent transportation systems (ITS), the impact of ITS on the environment and the economy, exploring the advanced traveler information systems, investigating the different smart payment systems and public transportation technologies, transportation planning in ITS, basics of transportation modeling and simulation, and computer and AI applications in simulation. | | | |

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| Course number | Credit hours | Title of the course | Prerequisite-co-requisite |
|---|---|---|---|
| **0908593** | **3** | **Green Buildings and Sustainable Construction** | **Project Management and Value Engineering** |

Key aspects of sustainability in construction engineering, trends in green building design and construction, various international building rating systems such as Leadership in Energy and Environmental Design (LEED), which assesses green building design, construction, operation, and maintenance across various categories: Location and Transportation, Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, Innovation, and Regional Priority.

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| Approved by department council | Dr. Hesham Rabayah | Date of approval | **28/11/2023** |