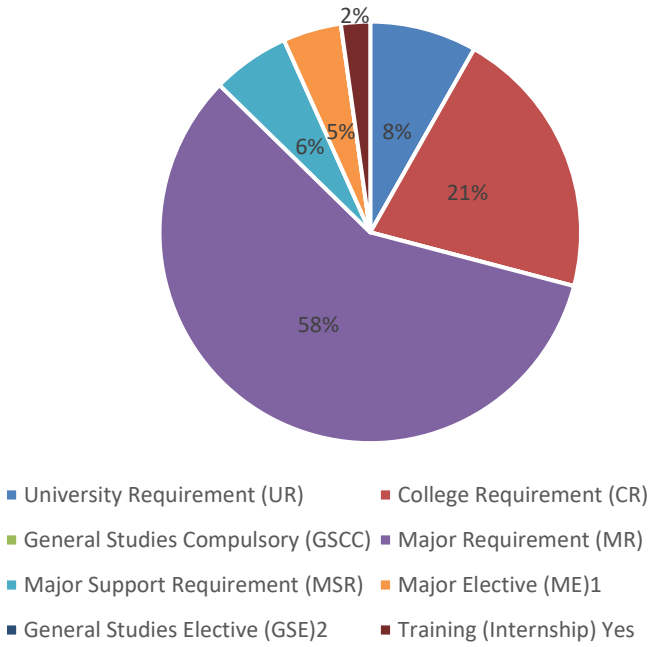
Bachelor of Science in Civil Engineering (Batches 2022-2024)

Program Components



University Requirement (UR)	**11**
College Requirement (CR)	**28**
General Studies Compulsory (GSCC)	**--**
Major Requirement (MR)	**78**
Major Support Requirement (MSR)	**8**
Major Elective (ME)[1]	**6**
General Studies Elective (GSE)[2]	**--**
Training (Internship) **Yes**	**1**
Total Credit (CRD)	**132**

[1] Student must select five (3XX & 4XX) courses from Major Elective(ME) List. Additional to this, two courses must be selected from ME list as Job Placement Courses. This needs consultation and approval of the department.

[2] Student must select three General Studies Electives, one of them must be from Humanities and Social Science.
Note:

- Free Elective Courses any UOB course excluding:(1) courses offered for special students, (2) courses covered in the B.Sc. curriculum, (3) courses equivalent or lower than those already taken in the curriculum and should not be a science course prepared by College of Science for other colleges.

- HU/SS Courses - Humanities and Social Science Component: Any course from the following:
  Humanities: Fine Arts, History, American Studies, Classics, Communications, English, (Foreign Language) French, Music, Philosophy, Theatre, Literature (Arabic), Religion (comparative).
  Social Science: Anthropology, Economics, Education, Geography, History, Psychology, Sociology, Women's Studies, Political Science.

Detailed Study Plan

Year 1 - Semester 1

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CHEMY101	General Chemistry I	3	3	4	CR	--	No
CENG103	Computer Programming & Applications for Civil Engineering	2	3	3	MR	--	No
ENGL101	Communication Skills I	3	0	3	CR	--	No
MATHS101	Calculus I	3	0	3	CR	--	No
PHYCS101	General Physics I	3	3	4	MSR	--	No

Year 1 - Semester 2

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CENG131	Surveying	3	3	4	MR	MATHS101	Yes
CENG160	Engineering Graphics & CAD	2	3	3	MR	CENG103	Yes
MATHS102	Calculus II	3	0	3	CR	MATHS101	No
PHYCS102	General Physics II	3	3	4	MSR	PHYCS101	No
ARAB110	Arabic Language Skills	3	0	3	UR	--	No

Year 2 - Semester 3

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CENG201	Civil Engineering Materials	2	3	3	MR	CHEMY101	Yes
CENG211	Statics	3	1	3	MR	MATHS102 & PHYCS102	Yes
MATHS205	Differential Equations	3	0	3	CR	MATHS102	No
HIST122	Modern History of Bahrain & Citizenship	3	0	3	UR	--	No
STAT276	Statistical Data Analysis for Engineering	3	0	3	CR	MATHS102	No
ENGL242	Report writing and Presentation	3	0	3	CR	ENGL101	No

Year 2 - Semester 4

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CENG202	Numerical Analysis	2	3	3	MR	MATHS205	Yes
CENG212	Mechanics of Materials	3	1	3	MR	CENG211	Yes
CENG231	Fluid Mechanics	2	3	3	MR	MATHS102 & CENG211	Yes
ISLM101	Islamic Culture	3	0	3	UR	--	No
MATHS203	Calculus III	3	0	3	CR	MATHS102	No
CENG209	Introduction to Engineering Profession	2	3	3	MR	ENGL242	Yes

Year 3 - Semester 5

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CENG302	Construction Engineering	2	2	3	MR	CENG160	Yes
CENG307	Structural Analysis	3	0	3	MR	CENG202 & CENG212	Yes
CENG321	Hydraulics	2	2	3	MR	CENG231	Yes
CENG331	Highway Engineering	3	0	3	MR	CENG131 & CENG202	Yes
CENG345	Soil Mechanics and Behavior	3	2	4	MR	CENG212	Yes
HRLC107	Human Rights Principles	2	0	2	UR	---	No

Year 3 - Semester 6

Course Code	Course Title	Course Hours			Course Type	Pre Requisite	Major GPA
		LEC	PRAC	CRD			
CENG305	Introduction to Quantity Surveying	3	1	3	MR	CENG160 & CENG302	Yes
CENG315	Reinforced Concrete Design	3	1	3	MR	CENG201 & CENG307	Yes
CENG322	Water Supply & Sewerage	2	3	3	MR	CENG321	Yes
CENG317	Structural Steel Design	3	1	3	MR	CENG307	Yes
CENG328	Civil Engineering Projects and Seminar	2	3	3	MR	CENG302	Yes
MENG303	Engineering Economics	3	1	3	CR	Completion of 70 cr.	No

Training Requirement

Course Code	Course Title	Course Hours			Course Type	Pre Requisite	Major GPA
		LEC	PRAC	CRD			
CENG395	Industrial Training	0	3	1	MR-industr ial	Completion of 85 cr.	Yes

Year 4 - Semester 7
(Civil Engineering Track)

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CENG404	Software Applications in Civil Eng.	2	3	3	MR	CENG315	Yes
CENG426	Wastewater Treatment	2	3	3	MR	CENG322	Yes
CENG431	Traffic Engineering	3	1	3	MR	CENG331 & STAT276	Yes
CENG4XX	Elective I	3	X	3	ME	As per list	Yes
CENG495	Senior Project I	0	6	2	MR	Completion of 85 cr.	Yes

Year 4 - Semester 8
(Civil Engineering Track)

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CENG406	Construction Management	3	1	3	MR	CENG302& CENG305	Yes
CENG442	Foundations	3	1	3	MR	CENG345	Yes
CENG4xx	Elective II	3	1	3	ME	As per list	Yes
CENG496	Senior Project II	0	6	2	MR	CENG495	Yes

Year 4 - Semester 7
(Structural Engineering Track)

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CENG460	Computer Analysis and Design of Structures	2	3	3	MR	CENG315	Yes
CENG468	Design of Reinforced Concrete Structures	2	3	3	MR	CENG315	Yes
CENG470	Design of Steel Structures	2	3	3	MR	CENG317	Yes
CENG4XX	Elective I	3	0	3	ME	As per list	Yes
CENG495	Senior Project I	0	6	2	MR	Completion of 85 cr.	Yes

Year 4 - Semester 8
(Structural Engineering Track)

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CENG472	Topics in Building Design	3	1	3	MR	CENG460	Yes
CENG476	Design of Reinforced Concrete Foundations	3	1	3	MR	CENG468	Yes
CENG4xx	Elective II	3	1	3	ME	As per list	Yes
CENG496	Senior Project II	0	6	2	MR	CENG495	Yes

Year 4 - Semester 7
(Construction Engineering Track)

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CENG466	Construction Contracts and Law	2	3	3	MR	CENG302	Yes
CENG492	Construction Technology	2	3	3	MR	CENG302	Yes
CENG493	Project and Site Management	2	3	3	MR	CENG302	Yes
CENG4XX	Elective 1 (structures)	3	0	3	ME	As per list	Yes
CENG495	Senior Design Project I	0	6	2	MR	Completion of 85 cr.	Yes

Year 4 - Semester 8
(Construction Engineering Track)

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
CENG494	Construction Productivity and Quality Management	3	1	3	MR	CENG493	Yes
CENG482	Building Information Modeling	3	1	3	MR	CENG302	Yes
CENG4xx	Elective II	3	1	3	ME	As per list	Yes
CENG496	Senior Design Project II	0	6	2	MR	CENG495	Yes

Major Elective Courses

Course Code	Course Title	Course Hours			Course Type	Pre requisite	Major GPA
		LEC	PRAC	CRD			
Civil Engineering Track							
CENG466	Construction Contracts and Law	3	0	3	ME	CENG302	Yes
CENG468	Design of Reinforced Concrete Structures	3	1	3	ME	CENG315	Yes
CENG415	Precast & Prestressed Concrete	3	0	3	ME	CENG315	Yes
CENG425	Hydrology	3	0	3	ME	CENG321	Yes
CENG429	Environmental Engineering Design	3	1	3	ME	CENG426	Yes
CENG432	Traffic Flow and Capacity Analysis	3	1	3	ME	CENG331	Yes
CENG461	Principles of Pavement Design	3	2	3	ME	CENG345	Yes
CENG439	Geomatics Applications in Civil Engineering	3	2	3	ME	CENG331	Yes
CENG469	Ground Improvement	3	0	3	ME	CENG345	Yes
CENG451	Special Topics in Civil Engineering	3	0	3	ME	Dept. Consent	Yes
Structural Engineering Track							
CENG415	Precast & Prestressed Concrete	3	0	3	ME	CENG315	Yes
CENG478	Bridge Engineering	3	0	3	ME	CENG468	Yes
CENG479	Earthquake Engineering	3	0	3	ME	CENG468	Yes
CENG480	Rehabilitation of Structures	3	0	3	ME	CENG315	Yes
Construction Engineering Track							
CENG483	Tendering, Procurement and Contract Management	3	0	3	ME	CENG305	Yes
CENG497	Mechanical and Electrical Systems in Buildings	3	0	3	ME	CENG302	Yes
CENG498	Construction Cost Estimation and Cost Engineering	3	0	3	ME	CENG302	Yes
CENG499	Lean Construction Methods and Applications	3	0	3	ME	CENG302	Yes

Course Description

Course Code: CENG 103 **Course Title:** Computer Programming & Applications for Civil Engineering
Introduction to computers, numbering systems, algorithmic problem solving. Introduction to the useful and powerful mathematical tool MATLAB and computer programming. Basic features of MATLAB. Scalars and variables. Input/output. Operations with scalars and creating and using arrays Vectors and matrices. Program flow control, functions: built-in functions and user defined functions, 2D and 3D graphics. Programming examples with MATLAB.

Course Code: CENG 131 **Course Title:** Engineering Graphics & Computer Aided Drawing
Theory of errors, tape and offset surveying, leveling, theodolite, electronic distance measurement, surveying methods, setting out, circular curves, earthwork quantities, introduction to photogrammetry.

Course Code: CENG 160 **Course Title:** Computer Applications in Civil Engineering Computers
General introduction to engineering drawing, lettering, use of instruments and types of lines, geometrical constructions. Projections: isometric, oblique and orthographic. Simple sectional drawings. Introduction to microcomputers, AutoCAD for two dimensional drawings, architectural drawings with AutoCAD, structural drawings with AutoCAD, miscellaneous civil engineering drawings with AutoCAD.

Course Code: CENG 201 **Course Title:** Civil Engineering Materials
Composition of concrete, properties of concrete, cement and aggregates. Proportioning, gradation, admixtures. Forms for concrete, placing and curing, properties of hardened concrete, Bituminous materials for asphalt, concrete mix design, timber.

Course Code: CENG 202 **Course Title:** Numerical Analysis
Analysis of error in numerical computations, roots of nonlinear equations, numerical solution of linear and nonlinear systems of equations, interpolation and approximation. Numerical differentiation and integration, numerical solution of ordinary differential equations.

Course Code: CENG 209 **Course Title:** Introduction to Engineering Profession
Engineering as a profession, Ethics, and technology: Ethics (including professional ethics), Interaction technology and society, Corporate Responsibility, Sustainability, Teamwork/ Group Processes, Project work, Innovation/change expertise, Dissemination, project management.

Course Code: CENG 211 **Course Title:** Statics
Introduction to the problems of mechanics of rigid bodies, basic concepts, force and displacement as vectors, force systems, equivalent force systems. Equilibrium of force systems (static equilibrium). Analysis of simple structures: plane and space trusses, beams and frames, center of gravity, moment of inertia.

Course Code: CENG 212 **Course Title:** Mechanics of Materials
Introduction to stress and strain concepts, stresses and deformations of axially loaded members, state of stress and state of strain with emphasis on two dimensional problems. Mechanical properties of materials, Hook's law, Poisson's ratio. Normal and shear stresses and deflections in beams. Torsion of circular bars, combined stresses. Elastic and inelastic buckling of axially loaded bars. Experiments.

Course Code: CENG 231 **Course Title:** Fluid Mechanics
Fluid properties, units of measurements, fluid statics, fluid pressure, manometers, forces on surfaces, floating bodies, kinematics of fluid flow, principle of conservation of mass, equation of motion. Dynamics of fluid flow. Integration of Euler's equation, Bernoulli's equation, and its applications. Momentum equation and simple applications. Dimensional analysis and similitude. Experiments.

Course Code: CENG 302 **Course Title:** Construction Engineering
Construction team and construction site activities. Site supervision and documentation. Site health and safety requirements. Earth moving and heavy construction activities. Aggregate, concrete, and asphalt production. Foundation works. Concrete, structural steel and masonry construction techniques.

Course Code: CENG 305 **Course Title:** Introduction to Quantity Surveying

Construction team and construction site activities. Site supervision and documentation. Site health and safety requirements. Earth moving and heavy construction activities. Aggregate, concrete, and asphalt production. Foundation works. Concrete, structural steel and masonry construction techniques.

Course Code: CENG 307 **Course Title:** Structural Analysis
Calculation of design loads and load paths for buildings and other structures. use of classical analysis techniques to determine support reactions, internal member forces in plane trusses and frames, shear and moment diagrams, influence lines and energy theorems, structural displacements of statically determinate and indeterminate structural system.

Course Code: CENG 328 **Course Title:** Civil Engineering Projects and Seminar
The course is meant to develop creative design and critical thinking skills of the students by exposing them to some ongoing important projects in the country and in the world (online) requiring them to submit reports and organize an end of term seminar to present their views and acquired knowledge highlighting various design components. Field trips and visiting lectures may be arranged in coordination with the industry. The course will emphasize on developing essential civil engineering skills, working in groups, and using problem-based learning to find solutions to real engineering problems, inspiring the method of turning theoretical teaching into practice, hands-on modeling as ways of communicating ideas, giving critical feedback on design responses, generating ideas to assess feasibility of design concepts, and reflecting role of civil engineers as designers and decision makers.

Course Code: CENG 315 **Course Title:** Reinforced Concrete Design
Basic behavior, analysis, and design requirements for typical reinforced concrete members. Detailed response of reinforced concrete beams in flexure. Load path tracing in buildings. Design requirements of British Standards BS 8110-1997 for members in flexure, shear, and columns. Analysis of continuous beams by moment and shear coefficients. Interaction diagrams for columns. Bond and anchorage of reinforcement. Serviceability requirements.

Course Code: CENG 317 **Course Title:** Structural Steel Designs
Introduction to design of steel structures. Limit state design, British Standards 5950, steel sections, design of tension members, bolted and welded connections. Design of compression members, lateral torsional buckling, design of beams and beam-columns, design of base plates.

Course Code: CENG 321 **Course Title:** Hydraulics
Closed conduit flow: laminar flow, relation between shear and pressure gradient, flow through circular pipes. Turbulent flow; velocity distribution, resistance of smooth and artificially roughened pipes, losses in pipes. Open channel flow: types, state and regime of flow, channel geometry. Energy and momentum principle, specific energy and force, uniform flow in channel and sewer, and channel design. Critical flow. Gradually varied flow; profiles and computation. Hydraulic jump. Experiments.

Course Code: CENG 322 **Course Title:** Water Supply and Sewerage
Fundamentals of groundwater flow, water transmission by pipelines, design of conduits, water distribution systems, reservoirs, pumping stations, wastewater systems, hydraulics of wastewater flow, design of sanitary sewers, manholes, house and building connections, population estimate, peak factors, sewer pump selection, construction, and maintenance of sewer systems.

Course Code: CENG 331 **Course Title:** Highway Engineering
Introduction to transportation systems, highway planning and surveys, highway financing and economy, principle of highway locations, elements of geometric design of highways, grading operations, subgrade, subbase and base courses, pavement types, highway drainage.

Course Code: CENG 345 **Course Title:** Soil Mechanics and Behavior
Formation and composition of soils and rocks, nature of soils, physical properties and relationships among them, particle size analyses, consistency of soil, classification of soils and rocks, Compaction, Geostatic stresses, hydrostatic and excess pore water pressures, capillarity, concept of effective stress. Permeability and its measurement, Darcy's law.

Course Code: CENG 345 **Course Title:** Soil Mechanics and Behavior

Formation and composition of soils and rocks, nature of soils, physical properties and relationships among them, particle size analyses, consistency of soil, classification of soils and rocks, Compaction, Geostatic stresses, hydrostatic and excess pore water pressures, capillarity, concept of effective stress. Permeability and its measurement, Darcy's law. Bernoulli equation, two-dimensional steady flow through soils, seepage and flow nets, Mohr- coulomb shear strength theory. Measurement of shear strength parameters. Compressibility and consolidation. Volume changes, Experiments.

Course Code: CENG 395 **Course Title:** Industrial Training
In the industrial training course, all students in the program must participate in an approved training program in the relevant industry. At the completion of 300 hours of supervised training each student must submit a formal report and conduct an oral presentation.

Course Code: CENG 404 **Course Title:** Software Application in Civil Engineering
Introduction to commercial software, structural modeling, one, two and three dimensional elements, local and global coordinate systems, nodal displacements and element forces in both coordinates, stiffness matrix of one dimensional elements in local and global coordinate systems, support conditions, analysis and design of trusses, simple and continuous beams and frames made of steel and reinforced concrete materials by software, two dimensional elements, plane strain and plane stress, analysis of design of reinforced concrete slabs, shear walls by software, verification of outputs from software. 3D solid elements.

Course Code: CENG 406 **Course Title:** Construction Engineering
Planning techniques, company organization, estimating and tendering, project control: CPM techniques scheduling; legal aspects of construction, change orders, bonds, contract documents: drawings, bill of quantities, specifications, and forms of contract.

Course Code: CENG 426 **Course Title:** Wastewater Treatment
Physical, chemical and biological characteristics of wastewater, impact of major contaminants on human health and environment. Design principles of the various treatment processes used for the removal of the major contaminants including preliminary, secondary and tertiary treatment units. Experiments.

Course Code: CENG 431 **Course Title:** Traffic Engineering
Driver and vehicle characteristics, highway alignment, spot speed, volume, travel time and delay studies. Basic traffic flow theory, basic freeway capacity, capacity of two-lanes rural highways and level of service. Signalized intersections and accident studies. Applications in highways and traffic engineering.

Course Code: CENG 442 **Course Title:** Foundations
Foundations: importance and purpose, site investigations, bearing capacity, shallow foundations, settlements, mat foundations, lateral earth pressure and retaining walls, deep foundations, soil improvements.

Course Code: CENG 495 **Course Title:** Senior Design Project I
This course provides the foundations of the senior design project. It includes technical report writing, design constraints and standards, project proposal redaction, literature review, and preparation for the needed project constituents. It also gives hands on practical skills needed for the project implementation such as program-specific tools and techniques. At the end of the course, the students are evaluated based on a written report and oral presentation of a developed preliminary design and implementation timed plan (e.g., Gantt Chart). Students are also teamed and connected to their supervisors with an approved project title. Accordingly, they are ready to embark on the next course (Senior Design Project II).

Course Code: CENG 496 **Course Title:** Senior Design Project II
This course builds on the foundations acquired during Senior Design Project I. It is the culmination of the learning endeavor that the senior students have gone through enabling them to apply the engineering knowledge they acquired towards the final implementation and testing of the project they have already selected. Written formal reports, posters, and oral presentations are required for their evaluations at the end of the course.

Course Code: CENG 415 **Course Title:** Precast and Prestressed Concrete

Introduction, analysis of prestressed concrete section in flexure, Prestress loses. Design of prestressed concrete members. Composite design. Ultimate strength design. Design for shear. Indeterminate structures. Introduction to precast concrete. Applications. Specifications and codes of practice.

Course Code: CENG 425 **Course Title:** Hydrology
The hydrologic cycle, climatology. Precipitation: forms and types and Gauges, interpretation of precipitation data. Evaporation and transpiration. Infiltration. Stream flow; Stream flow hydrographs; characteristics and synthesis. Statistical and probability analysis of hydrological data. Hydrologic principles in engineering design. Water-shed modeling.

Course Code: CENG 429 **Course Title:** Environmental Engineering Design
Main contaminants of concerns in Municipal Wastewater and their impacts on human health and environment and the design principles of the various sludge treatment units used for their treatment and disposal including thickening, digesting, composting, conditioning and dewatering treatment units, and treated sludge effluent incineration and disposal.

Course Code: CENG 432 **Course Title:** Traffic Flow and Capacity Analysis
Traffic control devices, applications of control measures, traffic analysis and prediction, traffic flow theory, traffic signal control, highway capacity for freeways, urban and rural areas, accident studies. Parking studies.

Course Code: CENG 461 **Course Title:** Principles of Pavement Design
Introduction, stresses in flexible pavements, stresses in rigid pavements. Environmental factors; material behavior and characterization. Vehicle and traffic conditions. Design of highway pavements. Design of airport pavements.

Course Code: CENG 439 **Course Title:** Geomatics Application in Civil Engineering
Comprehensive instruction in the underlying concepts and principles of geospatial engineering and its application in the design and analysis of civil and environmental engineering systems. It focuses on spatial data acquisition, geoprocessing, querying, geostatistical methods, visualization, network modeling, topographic mapping, terrain mapping, and thematic mapping. Students will gain awareness of geomatics computer software, hardware, and peripherals along with the fundamentals of photogrammetry, remote sensing, GPS and GIS. Students will conduct final projects to apply their gained to various disciplines of civil engineering.

Course Code: CENG 451 **Course Title:** Special Topics
Any important, relevant, and possibly hot topic in the field that is not covered in the approved elective list. Topics may vary based on students' interest and availability of staff.

Course Code: CENG 466 **Course Title:** Construction Contracts and Law
Introduction, judicial procedures in Bahrain courts as they relate to the practicing engineer, Bahrain civil law, elements of legal contract, sources of law, terms of contract, General Conditions of Contract. void and voidable contract, factors vitiating a contract, remedies of breach of contract, construction insurance, construction bonds, claims and dispute resolution methods.

Course Code: CENG 468 **Course Title:** Design of Reinforced Concrete Structures
Load arrangement for moment and shear envelope. Simplification of large frames into subframes. Structural detailing and drafting of solid one-way slabs, beams, and girders. Detailed design requirements for short and slender columns with uniaxial or biaxial bending. Moment magnification in slender braced and unbraced columns. Construction methods of floor slabs including cast-in-situ one-way solid slabs, cast-in-situ two-way solid slabs, beamless flat slabs, ribbed and waffle slabs, precast hollow core slabs.

Course Code: CENG 469 **Course Title:** Ground Improvement
Types of ground improvement techniques, chemical and mechanical improvements, various compaction methods, vertical drains, heating and freezing methods, blasting methods, grouting, micro piles, soil nailing, use of geotextiles, geosynthetics, and geocells, reinforced earth, land reclamation.

Course Code: CENG 460 **Course Title:** Computer Analysis and Design of Structures
Structural modeling using commercial analysis and design software. Types of coordinate system, joints, and elements. Introduction to matrix methods: element stiffness matrix, global stiffness matrix, system of equations, and

solution. One dimensional beam element. Simple beams, continuous beams, and frames. Trusses. Plate elements. Slabs and shear wall analysis. Shell elements. Shells of revolutions. 3D solid elements. Support modeling. Internal force releases (hinges). Loading in global coordinates and local coordinates. Verification of solutions. Concrete Design. Steel Design.

Course Code: CENG 470 **Course Title:** Design of Steel Structures
Plastic design of steel structures, design of plate girders, composite beams, design of beam- column connections, design of roof trusses, and design of single storey industrial building.

Course Code: CENG 472 **Course Title:** Topics in Building Design
Covers different subjects related to building design. Loading on buildings and structures as presented in ASCE 7 and IBC codes. Dead loads. Live loads in buildings and bridges. Wind loads. Earthquake loads. Snow loads. Natural frequency. Earth loads. Load combinations and factors of safety. Lateral load resisting systems (Bracing) and transfer in buildings including X bracing, K bracing, Shear Walls, Shear Shafts/Cores. Diaphragm design. Fire rating of structural assemblies and fire protection in buildings. Consideration in tall buildings design. Means of egress. Control joints. Structural drawings: notes, plans, elevations, and sections. Structural specifications. Liquid Storage Tanks. Communication Towers. Power Transmission towers.

Course Code: CENG 476 **Course Title:** Design of Reinforced Concrete Foundations
This course covers the structural design of the concrete part of the foundations. Pad footings, concentric footings, eccentric footings, combined footings, strip footings, wall footings, raft foundations, pile design, pile caps. Shear wall footings. Shear core footings. Uplift design. Piles in tension.

Course Code: CENG 478 **Course Title:** Bridge Engineering
Types of bridges. Loads on bridges. Longitudinal and transverse load distribution. Types of deck. Joints. Abutments. Wearing surface. Bearings. Piers. Abutments. Steel bridges: rolled beams, plate girders, truss, and composite deck. Concrete bridges: reinforced concrete, prestressed I-Beams, box girders, arched, cantilever construction, and composite deck. Suspension and cable stayed bridges. Corrosion protection methods. Fatigue. Inspection and Rehabilitation. Vortex shedding, resonance, and lateral stability. Torsional considerations.

Course Code: CENG 479 **Course Title:** Earthquake Engineering
Causes and classification of earthquakes. Linear elastic dynamic analysis: SDOF, MDOF, simple beams, FEM. Behavior of structures under seismic excitation. Design of earthquake resistant design to IBC. Seismic provisions for the design of reinforced concrete buildings to ACI 318. Seismic provisions for the design of steel structures to AISC. AASHTO provisions for earthquake resistant bridges. Diaphragm's design. Torsional effects. P-Delta effects. Seismic isolation. Ductility. Damping and dissipation of energy.

Course Code: CENG 480 **Course Title:** Rehabilitation of structures
During the life span of any structure, many will face deterioration and require rehabilitation. There are many aspects that need to be considered including: protection methods against corrosion and deterioration, inspection of existing structures, and repair and rehabilitation of the structure. Causes and types of corrosion and deterioration in steel structures: uniform corrosion, galvanic corrosion, pitting, erosion, stress corrosion, hydrogen damage, fatigue, weld cracking. Non-destructive testing and destructive testing of steel structures. Corrosion prevention. Application: steel oil storage tanks. Causes and types of deterioration in concrete structures: cracking, corrosion of reinforcement, carbonation, chemical attack, erosion, and spalling. Non-destructive testing and destructive testing of concrete structures. Protection methods of reinforced concrete structures. Rehabilitation methods and techniques. Cathodic protection. Corrosion inhibitors. Coatings.

Course Code: CENG 482 **Course Title:** Building Information Modeling
Use of Building Information Model (BIM), its benefits in design and construction. collaborative design, clash detection, level of development (LOD), BIM contracts, automated code checking, simulation, BIM and lean applications, and integrated project delivery.

Course Code: CENG 492 **Course Title:** Construction Technology
The aim of this course is to provide the students with an understanding of the different elements that make-up a building and the technological aspects of simple and framed buildings including their elements and components, their functional and performance requirements, and options available for onsite and offsite construction.

Understanding of the practical technologies involved in civil engineering and infrastructure construction projects such as the construction of highways, bridges, and utility networks This is to enable students to communicate effectively with construction professionals in the design and construction of buildings.

Course Code: CENG 493 **Course Title:** Project and Site Management
The aim of this course is to provide students with an understanding of construction project management principles and techniques. This course provides the basic understanding of the management processes involved in delivering a construction project from the design process to the construction and final delivery to the client. Students will also briefly learn about planning and programming work, managing contractors, health and safety, site organization and layout.

Course Code: CENG 494 **Course Title:** Construction Productivity and Quality Management
Introduction to the application of scientific principles as they relate to the measurement and forecasting of productivity in construction engineering, conceptual and mathematical formulation of labor, equipment, and material factors affecting productivity, notions of quality, quality transition, quality control and inspection, quality assurance, total quality management as well as a system approach to managing quality.

Course Code: CENG 483 **Course Title:** Tendering, Procurement and Contract Management
Throughout the course student will learn about the ways in which construction projects can be procured & managed using a variety of methods. This course enables student to explore and differentiate the principal types of procurement systems and associated contracts and how risks are distributed among the parties in different types and systems. Student will also explore the fundamental procedures related to contract administration.

Course Code: CENG 497 **Course Title:** Mechanical and Electrical Systems in Buildings
Introduction to the materials and methods for mechanical and electrical construction systems and drawings. HVAC, water and wastewater, power distribution, lighting, and fire protection. Blueprint reading and quantity takeoff.

Course Code: CENG 498 **Course Title:** Construction Cost Estimation and Cost Engineering
Conceptual and detailed cost estimating. Theory and practice of estimating construction costs of materials, labor, equipment, contingency, overhead and markup. Estimating competencies and bid ethics. Electronic quantity take-off and pricing methods. Assembly's costs, unit costs, production rates. Analysis of project profitability, cost analysis and cost control methods. Value engineering. Life cycle cost analysis.

Course Code: CENG 499 **Course Title:** Lean Construction Methods and Applications
Lean theory, production control, value stream mapping, process improvement, project definition, lean design, integrated project delivery, advanced lean scheduling, risk assessment, budget under uncertainty and project monitoring

University Requirements Courses Descriptions

Course Code: ARAB 110 **Course Title:** Arabic Language Skills
This course focuses on basic Arabic skills including form, function, and meaning. It also helps the student to appreciate and understand structures and approach them from a critical point of view, through various genres in literature.

Course Code: HIST 122 **Course Title:** Modern History of Bahrain and Citizenship
Spatial identity of Bahrain: Brief history of Bahrain until the 18th century; the historical roots of the formation of the national identity of Bahrain since the 18th century; the modern state and evolution of constitutional life in Bahrain; the Arabic and Islamic dimensions of the identity of Bahrain; the core values of Bahrain's society and citizenship rights (legal, political, civil and economic); duties; responsibilities and community participation; economic change and development in Bahrain; Bahrain's Gulf, Arab and international relations.

Course Code: HRLC 107 **Course Title:** Human Rights Principles
This course deals with the basic principles of human rights in terms of the definition of human rights, scope, sources with a focus on the International Bill of Human Rights; The Charter of the United Nations; Universal Declaration of Human Rights; The International Covenant on Civil and Political Rights; International Covenant on Economic, Social and Cultural Rights; Convention against Torture and other Cruel, Inhuman or Degrading Treatment or Punishment; Mechanics and the Constitutional Protection of Rights and Public Freedoms in Kingdom of Bahrain.

Course Code: ISLM 101 **Course Title:** Islamic Culture
An introduction to the general outline and principles of Islamic culture, its general characteristics, its relationships with other cultures, general principles of Islam in beliefs, worship, legislation and ethics.

College Requirement Courses Descriptions

Course Code: CHEMY 101 **Course Title:** General Chemistry I
Significant figures, chemical formulas and equations; mass relations, limiting reactions and theoretical yield; Physical behavior of gases; electronic structure, periodic table, covalent bonding; Lewis structures, Molecular structures, hybridization; molecular orbitals, solutions; colligative properties. Related practical work.

Course Code: ENGL 101 **Course Title:** Communication Skills I
This course focuses on reading skills and strategies and language development. The reading section concentrates on high-interest contemporary topics and encourages students to increase speed and efficiency. The writing component, integrated to the reading materials, reviews grammatical structures, develops language accuracy and introduces paragraph writing. Students are required to upgrade their grammar, reading and listening skills on the internet.

Course Code: MATHS 101 **Course Title:** Calculus I
Algebra. Functions and graphs. Trigonometry. Conic sections. Limits and continuity. Derivatives and integrals. Applications of derivatives which include Mean Value Theorem, extrema of functions and optimization. Definite integrals and the Fundamental Theorem of Calculus.

Course Code: MATHS 102 **Course Title:** Calculus II
Applications of definite integrals, including areas, volume, and surface areas of solids of revolution, arc length and centroids. Transcendental functions, indeterminate form, and L'Hopital's Rule. Techniques of integration and improper integrals. Infinite series, power series. Maclaurin and Taylor Theorem.

Course Code: MATHS 205 **Course Title:** Differential Equations
Differential equations of first order and their solutions. Separable and exact equations. Equations convertible to separable type. Higher order linear ODE's with constant coefficients (homogeneous and nonhomogeneous). Power series method for second order linear equations. Variation of parameters. Laplace transform techniques. Applications of differential equations.

Course Code: STAT 276 **Course Title:** Statistical Data Analysis for Engineering
Introduction to statistical methods for data analysis and interpretation. Statistical concepts, probability distributions, descriptive statistics and data visualization, confidence intervals, significance tests, Analysis of Variance (ANOVA), linear and nonlinear regression analysis. Principles of design of experiments, full factorial and fractional designs, statistical quality control. Tools: spreadsheet software (e.g. Microsoft® Excel) and programming environment (e.g. MATLAB®).

Course Code: ENGL 242 **Course Title:** Report Writing and Presentation
Technical Report Writing prepares students to design and compose effective technical documents, with particular emphasis on technical reports and oral presentations. The lecture hour is dedicated to theories, techniques and presentations. The tutorial hour is assigned to discuss the written reports feedbacks.

Course Code: MATHS 203 **Course Title:** Calculus III
Parametric equations and Polar coordinates. Vectors and surfaces. Limits, derivatives, and integrals of vector-valued functions. Partial differentiation. Multiple and line integrals and their applications. Green's and Stokes' Theorems.

Course Code: MENG 303 **Course Title:** Engineering Economics
Fundamentals of engineering economy. Time value of money. Present worth analysis. Annual worth analysis. Rate of return analysis. Replacement and retention analysis. Capital rationing. Breakeven analysis. Payback period analysis. Depreciation methods.

Major Support Requirement Courses Descriptions

Course Code: PHYCS 101 **Course Title:** General Physics I
Units and measurements; brief review of vectors; Newton's laws of motion; projectile motion; work and energy; impulse and momentum; rotational dynamics; equilibrium of a rigid body; periodic motion.

Course Code: PHYCS 102 **Course Title:** General Physics II
Electric charges and fields; Coulomb's and Gauss's laws, electric potential, capacitors and dielectrics, direct current circuits, Kirchhoff's rules, magnetic field and flux, Ampere's law, induced emf, Lenz's laws, mutual and self-inductance; AC circuits; RLC circuit