5.7 CONSTRUCTION ENGINEERING AND MANAGEMENT DEPARTMENT

The Department of Construction Engineering and Management (ES Department) offers a range of basic construction engineering and management courses relating to the major civil engineering disciplines to prepare the students to all educational programs of the department.

A student in the construction engineering and management department must successfully pass courses totalling at maximum of 176 credit hours, through at least five academic years of study (or 10 academic semesters). Table 3.96/Chapter 3 summarizes the distribution of the total credit hours required for this program.

5.7.1 DESCRIPTION OF ES DEPARTMENT THIRD SEMESTER COURSES

5.7.1.1 ES101 "ENGINEERING MATERIALS": 3Cr [2-2-1]
Pre-requisites: none

Course Catalogue Description:
The course introduces an overview of Classification of engineering materials, atomic and molecular structure, bonding and coordination. Properties relationship in materials (metals, ceramic glasses and polymers). Corrosion resistant materials, composites and their applications. Properties of alloys and composites. Testing of materials and selection factors for various applications. The course will focus on metals' properties, standard and quality control testing- Steel, Building stones- Bricks- Timber- Heat insulating and acoustic materials. Laboratory: Testing for QC, sample preparation and testing effect of service conditions on the properties of materials, testing of materials, for strength. Laboratory: evaluation.

5.7.1.2 ES102 "STRUCTURAL ANALYSIS (1)": 3Cr [2-3-0]
Pre-requisites: EB112

Course Catalogue Description:
The course introduces an overview of Types of structures and supports. Types of loads. Condition of static stability calculations of reactions. Definition of internal forces (normal force, shear forces, bending moments and twisting moments). Internal forces in the horizontal beams (cantilevers, simple beams, overhanging beams, Compound beams), Frames and Trusses. Influence lines for some structures.

5.7.1.3 ES103 "INTRODUCTION TO COMPUTER AIDED DESIGN (CAD) SYSTEMS": 3Cr [2-0-3]
Pre-requisites: EB142

Course Catalogue Description:
The aim of this course is to explore current CAD technologies and develop skills in the use of specialist CAD software to produce 2D and 3D design specifications, to transform CAD drawings into photo realistic virtual products and to gain an awareness of CAD data and how such information can be transformed to engineering drawings.
The AutoCAD program. Computers and operating system, setting up, drawing-operations, blocks and dimensions. Layers, area limits, view ports, Paper Space, Model Space, X-ref and introduction to 3-D. Printing and plotting. Rectangular, isometric and diametric projections.

5.7.1.4 ES104 "SURVEYING FOR ENGINEERS": 3Cr [2-1-2]
Pre-requisites: EB102

Course Catalogue Description:
This course gives an overview of engineering principles and application of surveying sciences, popular techniques and engineering uses of distance, angles and height difference measurements, mapping, setting out engineering structures and Total Station.

5.7.2 DESCRIPTION OF ES DEPARTMENT FOURTH SEMESTER COURSES

5.7.2.1 ES105 "INTRODUCTION TO CONSTRUCTION ENGINEERING": 3Cr [2-2-0]
Pre-requisites: none

Course Catalogue Description:

Overview of the construction industry, Introduction to construction engineering, Construction equipment, earthmoving machinery and properties, excavation and lifting, loading and hauling, compaction and finishing, concrete construction, concrete form design, concrete economics, construction economics, introduction to construction contracts, and Construction project life cycle

5.7.2.2 ES106 "CIVIL ENGINEERING DRAWING": 3Cr [2-2-1]
Pre-requisites: ES103

Course Catalogue Description:

This course gives an overview of civil engineering projects, Legend and symbols, Scales and drawing size, General layout and plans, Longitudinal and cross sections, Detailing, Earthworks and retaining walls, R.C. and Steel Sections.

5.7.2.3 ES107 "STRUCTURAL ANALYSIS (2)": 3Cr [2-3-0]
Pre-requisites: ES102

Course Catalogue Description:

The course introduces an overview of the basic of understanding of the discipline of structural analysis for indeterminate structures and how this is applied to the design of structures. Calculation of deformations by several methods such as double integration method, conjugate beam method and virtual work theorem. Analysis of indeterminate structures with the force method (the superposition concept). Using the moment distribution method to analyze indeterminate beams and frames. Applying the slope-deflection equations and/or the three-moment equation for analysis of indeterminate beams and frames.

5.7.2.4 ES108 "STRENGTH OF MATERIALS": 3Cr [2-3-0]
Pre-requisites: ES102

Course Catalogue Description:

The course introduces an overview of Properties of plane areas: - principal axes and principal moments of inertia, Mohr's circle. Distribution of normal stresses- normal stresses due to single and double bending in symmetric and non-symmetrical sections, eccentric normal forces, core theory. Distribution of shear stress – direct shear, shear in bending, line sections, shear flow, shear center, non-symmetrical sections. Torsion:- applications on power transmission shafts. Plane stresses and strains:- principal stresses and similarity between stresses and strains, strain rosette. Buckling of compression members under compression (columns)

5.7.3 DESCRIPTION OF ES DEPARTMENT FIFTH SEMESTER COURSES

5.7.3.1 ES201 "INTRODUCTION TO ENVIRONMENTAL ENGINEERING":
5.7.3.2 2Cr [2-1-0]
Pre-requisites: none

Course Catalogue Description:

The course introduces an overview of clean environmental standards, Rules and regulations applied to soil, water and air to keep healthy environment. Global warming - Sources of environmental pollution, Estimation of pollutants in the environment as Green house gases Presentation of suitable schemes for abatement and control. Pollution in Railway and roadway systems.

5.7.3.3 ES202 "CONCRETE MATERIALS": 3Cr [2-2-1]
Pre-requisites: ES101

Course Catalogue Description:

The course introduces an overview of concrete components (cement, aggregate, water and admixtures), concrete at early ages (hydration, curing and fresh concrete properties), mechanical behavior of concrete, concrete mix design, factors affecting concrete properties, durability of concrete.

5.7.3.4 ES203 "CONSTRUCTION PROJECT MANAGEMENT": 3Cr [2-2-0]
Pre-requisites: ES105

Course Catalogue Description:

Introduction to construction management, Characteristics of Construction Industry; Estimating techniques and procedure: approximate estimating, quantity surveying, project delivery systems, the design and construction process. Project definition and work breakdown structure, construction-planning Techniques. Cash flow Conceptual, Quality Management, and Safety Management

5.7.3.5 ES204 "SOIL MECHANICS (1)": 3Cr [2-2-1]
Pre-requisites: ES101

Course Catalogue Description:

Weight-volume relationships. Physical properties of soil. Soil classification. Permeability and seepage. Shear strength. Compressibility, consolidation and settlement. Introduction to lateral earth pressure and slope stability.

5.7.3.6 ES205 "BUILDING TECHNOLOGY": 3Cr [2-3-1]
Pre-requisites: none

Course Catalogue Description:

This course introduces the students to the working drawings, and its way of presentation. By the end of this course the student should be able to identify the different structure systems and will be able to understand and detail all the architectural and structural elements of a building; starting from the different types of footings, the building unit of a wall, the R.C. elements, different types of insulation and openings of a concrete structure.

5.7.4 DESCRIPTION OF ES DEPARTMENT SIXTH SEMESTER COURSES

5.7.4.1 ES206 "REINFORCED CONCRETE DESIGN (1)": 3Cr [2-3-0]
Pre-requisites: ES108, ES202

Course Catalogue Description:

Fundamentals and design theories based on ultimate strength design and elastic concept, according to the current Code requirements. Load factors. Analysis and design of reinforced concrete members subject to flexure, shear. Development length of reinforcement. Design of one-way and two-way slabs. Design of short columns.

5.7.4.2 ES207 "CONSTRUCTION PLANNING AND SCHEDULING": 3Cr [2-2-1]
Pre-requisites: ES203

Course Catalogue Description:

The course gives an overview of Project definition; scheduling and control models and techniques such as: AOA, AON, Bar chart and LOB; material, labor and equipment Loading and allocation; optimal schedules; project organization; documentation and reporting systems; and management and control , computerized scheduling using Primavera Ver. 6

5.7.4.3 ES208 "HYDRAULICS": 3Cr [2-2-1]
Pre-requisites: EB102

Course Catalogue Description:

The course introduces an overview of Fluid properties, Pressure measurements and applications, Total pressure on surfaces, Buoyancy; Fluid masses subjected to acceleration. Kinematics of fluid flow. Equation of Continuity, Euler, Bernoulli and Energy equations and their applications Momentum equation, Flow in pipe systems, pipe networks. Pumps. Hydraulics of open channel, types of open channel cross sections, types of flow.

5.7.4.4 ES209 " STRUCTURAL ANALYSIS (3)":3Cr [2-2-1]
Pre-requisites: ES107

Course Catalogue Description:

The course introduces an overview of Study of matrices- stiffness and flexibility for structural analysis. Matrix structural analysis (Stiffness method) of plane trusses, grids and frames: stiffness matrices for different structural members, overall stiffness equation for the structure, boundary condition, Introduction to finite element method.

5.7.4.5 ES210 " INTRODUCTION TO ELECTRICAL AND MECHANICAL SYSTEMS": 3Cr [2-2-0]
Pre-requisites: none

Course Catalogue Description:

The course introduces an overview of Electrical Engineering Technology (EET) & Mechanical Engineering Technology (MET).
The EET part of the course covers the fundamentals of circuit analysis such as Kirchhoff's laws, parallel and series circuits, and then applies that knowledge to various electrical installations in residential and industrial buildings (such as illumination networks in rural areas, data lines, telephone lines and antenna, control of air conditioning, audio systems and security devices).
The MET part of the course covers the fundamentals of HVAC components and systems, plumbing elements and features and other essential mechanical systems used in typical residential and institutional projects.

5.7.5 DESCRIPTION OF ES DEPARTMENT SEVENTH SEMESTER COURSES

5.7.5.1 ES301 "STEEL STRUCTURES DESIGN (1)": 3Cr [2-3-0]
Pre-requisites: ES102, ES108

Course Catalogue Description:

The course gives an overview of Construction materials, Design loads and criteria of steel structures, Stability of steel structures under different loading conditions, Design of different components of steel structures.

5.7.5.2 ES302 "REINFORCED CONCRETE DESIGN (2)": 3Cr [2-3-0]
Pre-requisites: ES206

Course Catalogue Description:

Serviceability limit states (deflection and cracking limit states) Design of floor systems: ribbed and flat slabs. Design of paneled beams Design of beams for torsion, combined shear and torsion by the strength method. Stair cases (slab type and cantilever type). Design of sections under axial forces with bending moments. Sections subjected to biaxial bending. Design of long columns.

5.7.5.3 ES303 "PROJECT COST ANALYSIS": 3Cr [2-2-0]
Pre-requisites: ES203

Course Catalogue Description:

This course gives an overview of the application of scientific principles to costs and estimates of costs in construction engineering, full analysis of cash flow, and cost control.

5.7.5.4 ES304 "HYDRAULIC STRUCTURES": 3Cr [2-2-0]
Pre-requisites: ES208

Course Catalogue Description:

Design of water crossing structures: culverts, syphons, aqueducts. Hydraulic and structural design. Structural design of retaining walls for inlet and exit wing walls. Design of weirs and escapes. Uplift forces acting on floor

5.7.5.5 ES310 "TRANSPORTATION AND TRAFFIC ENGINEERING": 3Cr [2-2-0]
Pre-requisites: none

Course Catalogue Description:

The course introduces an overview of the design, planning, operation, management, and maintenance of transportation systems. Principles for planning integrated multi-modal transportation systems (highways, air, rail, etc.). Functional design concepts are introduced for both the facilities and systems areas of study with life cycle costing procedures and criteria for optimization.

5.7.5.6 ES311 "ADVANCED TOPICS IN MATERIALS": 3Cr [2-2-0]
Pre-requisites: ES202

Course Catalogue Description:

The course gives an overview of Fatigue and fracture, failure theories applied to concrete and steel structural components, composites, polymers, Ferro cement.

5.7.5.7 ES315 "SURVEYING (2)": 3Cr [2-1-2]
Pre-requisites: ES104

Course Catalogue Description:

This course gives an overview of Total station instrument and its applications in setting out coordinates, Methods of setting out highways, Roads, Airports and runways and their correlated different types of curves, Tunnel survey, Setting out of water, Sewer and infrastructure networks, Setting out of construction 3D deformation mentoring. Introduction to geometric geodesy, Introduction to map projection, Introduction to grid coordinates and their transformation, Introduction to GPS basics of GPS, Methods of observing

5.7.6 DESCRIPTION OF ES DEPARTMENT EIGHTTH SEMESTER COURSES

5.7.6.1 ES305 "STEEL STRUCTURES DESIGN (2)": 3Cr [2-3-0]
Pre-requisites: ES301

Course Catalogue Description:

Introduction to elastic-plastic material behavior, plastic analysis and design of continuous beams and simple frames using load resistance factor design (LRFD); design of built-up beams and plate girders, optimum proportioning of I-beam, design of composite section.

5.7.6.2 ES306 "HIGHWAY ENGINEERING": 3Cr [2-2-1]
Pre-requisites: ES106

Course Catalogue Description:

Highway planning in rural and urban areas. Highway location studies. Engineering and aesthetic considerations. Geometric and structural design. Highway materials and drainage.
Highway construction. Highway safety engineering. Discussion of current highway design code. Complete geometric design of a two-lane highway. Introduction to computer software for geometric design.

5.7.5.8 ES307 "CONSTRUCTION PRODUCTIVITY": 3Cr [2-2-0]
Pre-requisites: ES303

Course Catalogue Description:

The course gives an overview of the application of scientific principles to the measurement and forecasting of productivity in construction engineering.

5.7.6.3 ES308 "COMPUTER AIDED DESIGN": 3Cr [2-0-3]
Pre-requisites: ES206, ES301

Course Catalogue Description:

The course introduces an overview of the commercial computer programs for analysis and design of structures. Implementing the basic knowledge in dealing with computer applications. Checking on model concepts. Using computer programs for solving structural problem.

5.7.6.4 ES309 "FOUNDATION ENGINEERING": 3Cr [2-3-0]
Pre-requisites: ES204, ES206

Course Catalogue Description:

This course deals with geotechnical engineering that emphasized on analysis and design of different types of foundation, retaining and sheet pile walls. The topics that are included; types of foundation, bearing capacity of shallow foundation, bearing capacity of deep foundations, pile foundations, retaining walls, and sheet pile walls.

5.7.6.5 ES312 "REINFORCED CONCRETE INDUSTRIAL STRUCTURES": 3Cr [2-3-0]
Pre-requisites: ES302

Course Catalogue Description:

Structural systems for large span halls and industrial buildings - Design of framed structures – Concrete hinges – Brackets and corbels - North-light structures - Concrete arches - Deep beams - Circular beams - Design concepts for water tanks - Rectangular tanks - Circular tanks.

5.7.6.6 ES313 "CONSTRUCTION RISK MANAGEMENT": 3Cr [2-2-0]
Pre-requisites: HU133

Course Catalogue Description:

The course introduces an overview of risk and uncertainty - Process of risk management (Risk identification) - Risk analysis (qualitative and quantitative) - Risk response planning - Risk monitoring and control - Utility concepts - Statistical decision theory - Development of modern statistical decision theory and risk analysis - Tools and techniques (Modeling of non-deterministic problems - Modeling and analysis of uncertainties. Decision-making; Decision tree. Simulation models; Monte Carlo simulation and application. Decision problems; Multi-objective decision problems; and optimal decisions. Practical risk evaluation. Risk benefit trade-offs.)

5.7.7 DESCRIPTION OF ES DEPARTMENT NINTH SEMESTER COURSES

5.7.7.1 ES401"WATER AND WASTE WATER ENGINEERING": 3Cr [2-2-0] Pre-requisites: ES201

Course Catalogue Description:

The course introduces an overview of Water Supply, Introduction and Definitions of important Fields of Environmental Engineering, environmental system, waste cycles and main Environmental problems. Wastewater Engineering Sewerage Systems, Wastewater Disposal – law 48/ 1982 and law 4/ 1994 - Sludge collection and treatment.

5.7.7.2 ES402 "HARBOR AND MARINE CONSTRUCTIONS": 3Cr [2-2-0] Pre-requisites: ES309

Course Catalogue Description:

The course gives an overview of waves, Harbor planning, planning and structural and hydraulic design of break waters, Design of gravity and sheet piles quay walls, design of marine platforms supported by off shore piles .

5.7.7.3 ES407 "DESIGN OF STEEL BRIDGES": 3Cr [2-2-0] Pre-requisites: ES305

Course Catalogue Description:

The course gives an overview of design criteria and considerations of steel bridges, bridge types, loads of different bridge types, stability of bridges against lateral loads, fatigue in steel bridges, and design of different components in steel bridges.

5.7.7.4 ES408 "REINFORCED CONCRETE HIGH RISE BUILDING": 3Cr [2-2-0] Pre-requisites: ES302

Course Catalogue Description:

Introduction – Structural systems for tall buildings - Structural analysis for gravity loads - Lateral loads due wind - Lateral loads due to earthquakes - Seismic design and detailing concepts – Design of frames with limited ductility - Design of frames with enough ductility – Design of shear walls.

5.7.7.5 ES403 "REPAIR AND MAINTENANCE OF BUILDINGS":3Cr [2-2-0] Pre-requisites: ES202

Course Catalogue Description:

Identification and evaluation of buildings defects, structural and nonstructural cracks, repair materials and techniques, maintenance plans for building and associated problems, maintenance-planning techniques, evaluation of maintenance efficiency.

5.7.8 DESCRIPTION OF ES DEPARTMENT TENTH SEMESTER COURSES

5.7.8.1 ES404 "CONSTRUCTION METHODS EQUIPMENT": 3Cr [2-2-0]
Pre-requisites: ES202, ES307

Course Catalogue Description:

The course introduces an overview Major construction equipment and concrete construction. Selection of scrapers, dozers, cranes, etc. based on applications, methods, and production requirements. Power generation, transmission, and output capacity of equipment engines. Calculation of transport cycle times. Concrete methods include mixing, delivery, and placement. Design of forms for concrete walls and supported slabs.

5.7.8.2 ES405 "CONSTRUCTION CONTRACTING": 3Cr [2-2-0]
Pre-requisites: none

Course Catalogue Description:

This course includes theory of law: composition, expression, diversity, application, sources, scope and construction of legal rule. It also includes introduction to the study of all contracts, their conditions and types in different fields with a special reference to the employment law in Egypt. It also presents an introduction to the basic construction industry and its problem: types of contracts, types of participants in a construction contract, formation principles of a contract, performance or breach of contractual obligations. Finally, it gives basic knowledge about Bidding logistics and strategies, Legal organizational structures and uses of specifications.

5.7.8.3 ES406 "QUALITY CONTROL OF CONSTRUCTION MATERIALS": 3Cr [2-2-0]
Pre-requisites: ES202

Course Catalogue Description:

The course gives an overview of Construction materials specification and test procedures. Sampling methods, data collection and statistical data distributions, development of quality assurance specifications and acceptance plans.

5.7.8.4 ES409 "PRESTRESSED CONCRETE": 3Cr [2-2-0]
Pre-requisites: ES302

Course Catalogue Description:

Introduction to pre-stressed concrete - Materials used in pre-stressed concrete - Methods of pre-stressing – Pre-stress losses - Analysis and design of pre-stressed concrete sections (pre-tensioned and post-tensioned) subjected to flexure – Cable profile for post tensioned beams - Deflection and camber - Design for shear – Anchorage zones.

5.7.8.5 ES410 "DESIGN OF REINFORCED CONCRETE BRIDGES": 3Cr [2-2-0]
Pre-requisites: ES302

Course Catalogue Description:

The course introduces an overview of reinforced concrete bridges - Structural systems for concrete bridges - Loads on bridges - Design of concrete slabs under wheel loads - Design and analysis of slab bridges - Design of slabs, cross girders and main girders for slab-beam bridges - Continuous main girders - Box-girder bridges - Bearings - Bridge sub-structures.

5.7.8.6 ES411 "SOIL MECHANICS (2)": 3Cr [2-2-0]
Pre-requisites: ES309

Course Catalogue Description:

This course gives an overview of advanced of excavation stability, Dewatering, wells, advanced difficult Soil, Measurement tools and field testing, Soil improvement and piles.

5.7.8.7 ES412 "DESIGN OF TEMPORARY STRUCTURES": 3Cr [2-2-0]
Pre-requisites: ES302, ES305

Course Catalogue Description:

Design of temporary structures used in the construction industry on various projects such as formwork, false work, scaffolding, cofferdams, and so forth by providing lectures and design examples, business aspects associated with the design and construction of temporary structures in the real world such as business practice, legal aspects, and design philosophy.

5.7.8.8 ES400-1 AND ES 400-2 "GRADUATION PROJECT": 4Cr [3-2-1]
Pre-requisites: departmental approval for ES400-1 and ES400-1 for ES400-2

Course Catalogue Description:

Students use all of their knowledge and previous design experience, particularly in the field of specialization and integrate all components of the curriculum together into one major project extending over the 9th and 10th semesters. Projects are industry- based. Completion of the requirements of ES 400-1 in addition to new requirements, presentation and discussion. The project is presented orally and assessed by faculty members and an external assessor.

5.7.9 DESCRIPTION OF "ES" COURSES TO BE OFFERED TO STUDENTS FROM OTHER DEPARTMENTS (NON-CIVIL ENGINEERS)

The following are the catalogue descriptions of the above mentioned courses.

5.7.9.1 ES251 "INTRODUCTION TO CIVIL ENGINEERING 3Cr [2-2-0]

Pre-requisites: EB112,EB122

Course Catalogue Description:
The course covers the following topics: Types of structure, beams and frames. Structure analysis, internal stresses, tension, compression, and shear. Understanding of building materials, its components and loads bearing. Also tests of compression and tension of concrete and steel members.

5.7.9.2 ES252 "THEORY OF STRUCTURE": 2Cr [1-2-0]

Pre-requisites: EB111

Course Catalogue Description:
This course introduces the architecture student to the understanding of structures, and the forces affecting them, through structural analysis for different types of structures, internal forces for beams, frames and trusses.
By the end of the course the student should be able to understand the difference between tension and compression structural elements, and be able to estimate approximately the dimensions of the structural elements in buildings.

5.7.9.1 ES253 "REINFORCED CONCRETE AND STEEL STRUCTURES": 2Cr [1-2-0]

Pre-requisites: ES252

Course Catalogue Description:
This course is an introduction to the principles, and methods of designing reinforced and pre stressed concrete structures.
The second part of the course is about steel structures, by the end of this course the student should be able to design small steel structures, identify steel sections used in his/her design, connections, and roughly calculate forces affecting this structure.

5.7.9.1 ES254 "SURVEYING": 2Cr [1-1-2]

Pre-requisites: EB101

Course Catalogue Description:
This course introduces student to the understanding and need for the surveying, recent developments in surveying instrumentation and computing techniques, also the student should be able to understand slope analysis, radial positioning and mapping systems.

5.7.9.1 ES256 "SOIL MECHANICS": 2Cr [1-0-2]

Pre-requisites: EB132

Course Catalogue Description:

This course introduces the students to the types of buildings foundation, different types of soil, soil tests, measurements, and capacities. Shallow foundations and Piles will be covered in details