Department of Structural Engineering

The department of Structural Engineering offers the following programs:

1. Graduate Diploma

1.1 Specialized Graduate Diploma in Structural Engineering

The student must complete 30 credit hours.
Compulsory courses: The student must complete the following 6 courses equivalent to 18 credit hours.
(0704 610 – 07 04 620- 07 04 630-07 04 641- 07 04 660, 07 04 650)
Elective courses: The student can choose the remaining credit hours from any other courses that are specified as "Diploma courses"

1.2 Specialized Graduate Diploma in Construction and Project Management

The student must complete 30 credit hours.
Compulsory courses: The student must complete the following 6 courses equivalent to 18 credit hours.
(07 04 610- 07 04 663- 07 04 643- 07 04 660- 07 04 661- 07 04 662)
Elective courses: The student can choose the remaining credit hours from any other courses that are specified as "Diploma courses"

2. Master Degrees

2.1 Master of Engineering in Structural Engineering

The student must complete 30 credit hours in the form of courses and an additional 3 credit hours in the form of a scientific report.
The student must select a number of courses from the available course list in the required structural engineering stream option. The department council specifies the M.Eng. degree specialization in structural engineering according to the courses to be studied.
The student is allowed to choose 2 courses from another major.

2.2 Master of Engineering in Construction and Project Management

The student must complete 30 credit hours in the form of courses and an additional 3 credit hours in the form of a scientific report.
The student must select a number of courses from the available course list in the required construction and project management stream option. The department council specifies the

M.Eng. degree specialization in construction and project management according to the courses to be studied.
The student is allowed to choose 2 courses from another major.

2.3 Master of Science in Structural Engineering

The student must complete 24 credit hours in the form of courses and an additional 8 credit hours in the form of a thesis.
The student must select a number of courses from the available course list in the required structural Engineering stream option. The department council specifies the M.Sc. degree specialization in construction and project management according to the courses to be studied.
The student is allowed to choose 2 courses from another major.

2.3 Master of Science in Construction and Project Management

The student must complete 24 credit hours in the form of courses and an additional 8 credit hours in the form of a thesis.
The student must select a number of courses from the available course list in the required construction and project management stream option. The department council specifies the M.Sc. degree specialization in construction and project management according to the courses to be studied.
The student is allowed to choose 2 courses from another major.

3. Doctor of Philosophy- Ph.D. Degree

3.1 Doctor of Philosophy in Structural Engineering

The student must complete 18 credit hours in the form of courses and an additional 24 credit hours in the form of a dissertation.
The student must select a number of courses from the available course list in the required structural engineering stream option. The student is allowed to choose 3 courses from another major.

3.1 Doctor of Philosophy in Construction and Project Management

The student must complete 18 credit hours in the form of courses and an additional 24 credit hours in the form of a dissertation.
The student must select a number of courses from the available course list in the required construction and project management stream option. The student is allowed to choose 3 courses from another major.

List of Diploma, Master and Ph.D. courses

No.	Course Code	Course Name	Credit Hours	Exam Duration
1	07 04 610	Advanced Structural Analysis and Computer Applications	3	3
2	07 04 611	Advanced Structural Systems and Applications	3	3
3	07 04 620	Soil Mechanics and Advanced Foundations	3	3
4	07 04 621	Site Exploration – Field and Laboratory Investigations	3	3
5	07 04 622	Rock Mechanics and Tunneling Engineering	3	3
6	07 04 630	Ultimate Design of Metallic Structures	3	3
7	07 04 631	Design of Composite Beams	3	3
8	07 04 632	Stability of Metallic Structures	3	3
9	07 04 633	Design of Special Metallic Structures	3	3
10	07 04 640	Properties and Testing of Materials.	3	3
11	07 04 641	Specifications of Construction Materials	3	3
12	07 04 642	Special Types of Concrete	3	3
13	07 04 643	Inspection, Quality Assurance and Control	3	3
14	07 04 650	Design of Reinforced Concrete Structures – 1	3	3
15	07 04 651	Pre-stressed Concrete -1	3	3
16	07 04 652	Shell and Space Structures	3	3
17	07 04 653	Design of RC Structures for Earthquake Resistance	3	3
18	07 04 654	Inspection, Assessment, Repair and Strengthening of Reinforced Concrete Structures	3	3
19	07 04 660	Conditions of Contracts for Works of Civil Engineering Construction (FIDIC)	3	3
20	07 04 661	Productivity Improvement in Construction Projects	3	3
21	07 04 662	Computer Applications in Construction Management	3	3
22	07 04 663	Construction Engineering	3	3
23	07 04 664	Management of Construction Companies	3	3
24	07 04 710	Stability of Structures I	3	3
25	07 04 711	Theory of Elasticity	3	3

26	07 04 712	Plastic Analysis of Structures	3	3
27	07 04 713	Structures Analysis of Plates & Shells	3	3
28	07 04 714	Structural Dynamics I	3	3
29	07 04 715	Structural Dynamics II	3	3
30	07 04 716	Analysis of Composite Structures	3	3
31	07 04 717	Finite Element I	3	3
32	07 04 718	Nonlinear Analysis of Structures I	3	3
33	07 04 720	Geo-environmental Engineering	3	3
34	07 04 721	Buried Structures and tunnels	3	3
35	07 04 722	Numerical Methods for Solving Soil Problems	3	3
36	07 04 723	Soil Dynamics	3	3
37	07 04 730	Stability of Structures -2	3	3
38	07 04 731	Metallic Space Structures	3	3
39	07 04 732	Metallic Tall Buildings	3	3
40	07 04 733	Optimum Design of Steel Structure	3	3
41	07 04 734	Cold Formed Structures	3	3
42	07 04 740	Time Dependent Properties and Failure of Hardened Concrete	3	3
43	07 04 741	Concrete Technology	3	3
44	07 04 742	Deterioration of Construction Materials and Materials of Repair	3	3
45	07 04 743	Non-Destructive Testing and Experimental Stress Analysis	3	3
46	07 04 744	Corrosion Theories of Metallic Materials.	3	3
47	07 04 745	Durability of Concrete	3	3
48	07 04 746	Introduction to Fracture Mechanics	3	3
49	07 04 750	Design of Reinforced Concrete -2	3	3
50	07 04 751	Pre-stressed Concrete -2	3	3
51	07 04 752	Analysis and Design of Tall Concrete Structure		
52	07 04 753	Mechanics of Concrete Structures	3	3

53	07 04 760	Linear Application Program in Civil Engineering	3	3
54	07 04 761	Risk Management, Insurance and Licensing	3	3
55	07 04 762	Quality Control in the Construction Process	3	3
56	07 04 763	Shallow Foundations	3	3
57	07 04 764	Claims, Liability and Dispute Resolution	3	3
58	07 04 810	Analysis of Space and Non-conventional Structures	3	3
59	07 04 811	Inelastic Seismic Performance and Damage Evaluation of Building Structures	3	3
60	07 04 812	Wind Engineering	3	3
61	07 04 813	Seismic Analysis of Structures	3	3
62	07 04 820	Limit Analysis of Soil Problem	3	3
63	07 04 821	Geotechnical Earthquake Engineering	3	3
64	07 04 830	Metallic Suspension Structures	3	3
65	07 04 831	Pre-stressed Metallic Structures	3	3
66	07 04 840	Value Engineering in the Construction Industry	3	3
67	07 04 850	Self-Compacting Concrete and High Performance Concrete	3	3
68	07 04 601	Diploma Project in Structural Engineering	3	Presentation
69	07 04 602	Diploma Project in Construction and Project Management	3	Presentation
70	07 04 701	Master of Engineering Report in Structural Engineering	3	Defense
71	07 04 702	Master of Engineering Report in Construction and Project Management	3	Defense
72	07 04 705	Master of Science Thesis in Structural Engineering	8	Defense

73	07 04 706	Master of Science Thesis in Construction and Project Management	8	Defense
74	07 04 801	Doctor of Philosophy Dissertation in Structural Engineering	24	Defense
75	07 04 802	Doctor of Philosophy Dissertation in Construction and Project Management	24	Defense

Description of Courses for Graduate Programs (Diploma- Master- Doctor of Philosophy)

07 04 610 Advanced Structural Analysis and Computer Application
Matrix analysis of structures. Stiffness method for analyzing trussed and framed structures. Approximate methods for structural analysis. Computer applications.

07 04 611 Advanced Structural Systems and Applications
Advanced lateral load resisting systems: special moment resisting frames, concentrically braced frames, eccentrically braced frames, dual systems and special truss moment resisting frames. Composite structures; space single layer and double layer lattice domes; double layer space trusses; cable net structures; membrane and fabric structures; air-supporting structures; deployable structures. Applications using structural-analysis computer programs.

0704612 Introduction to Theory of Elasticity
Definition of stress and strain; principal stresses and strains; stress deviation tensor and its invariants; octahedral stresses; Mohr's circles; equations of equilibrium; equations of compatibility; Hook's law; plane stress and strain case; principle of virtual work; Stress function; polar coordinates.

0704613 Introduction to Dynamics of Structures
Types of dynamic loads; equation of motion; free and forced vibration of single-degrees of freedom (SDF) systems; introduction to multi-degrees of freedom (MDF) systems.

0704614 Numerical Methods in Structural Analysis
Matrix analysis of structures; Stiffness method for analyzing trussed and framed structures; Approximate methods for structural analysis; Computer applications.

704615 Elasto-Plastic Analysis of Structures
Definition of plastic hinge; formation of plastic hinge in structures; The curvature and rotational ductility of plastic hinges; inelastic analysis of frames subjected to lateral static

loading; evaluating the inelastic seismic performance of frames designed according to the Egyptian code.

0704616 Introduction to Nonlinear Analysis
Definition of nonlinearity and its sources; methods of equilibrium check; solution of nonlinear problems: incremental and iterative solution techniques; tracing of equilibrium path beyond limit and bifurcation critical points; automation of load increments; convergence criteria.

07 04 620 Advanced Soil Mechanics and Foundations
Pile foundations: piles under vertical loads, piles under horizontal loads and analysis of pile groups. Machine foundations: soil dynamics, theory of vibrations, design of foundations for machines. Underground structures: types, geological investigations, earth/rock pressure on underground structures, specifications, and design and construction methods. A.R.E specifications of deep foundations.

07 04 621 Site Exploration – Field and Laboratory Investigation
Program for site investigation. Various methods of site investigation. Laboratory tests. Field tests. Field equipment for measuring soil displacements. Chemical analysis for soils and ground water.

07 04 622 Rock Mechanics and Tunneling Engineering
Definition. Rock formation. Physical properties and laboratory tests. Mechanical properties and their measurements. Field tests. Stress under surface loading. Lateral rock pressure. Stability of cuts. Site investigations. Foundation resting on rock. Types of tunnels. Geological investigations. Earth/rock pressure on tunnels. Planning of tunnels. Specifications and design construction methods.

07 04 630 Ultimate Design of Metallic Structures
Comparative study for the methods of design in metallic structures. Design of trusses using the ultimate strength method. Design of beams and frames .Design of connections.

07 04 631 Design of Composite Beams
Theory of composite structures. Design of simple and continuous girders .Effect of secondary stresses .Shear connectors. Methods of construction

07 04 632 Stability of Metallic Structures
Fundamentals and conditions of equilibrium. Types of loads .Types of bodies. Different methods for the critical load .Mathematical model for the stability of equilibrium. Critical loads of columns and beam-columns. Stability of frames. Torsion and torsional buckling. Lateral buckling. Buckling of plates .

07 04 633 Design of Special Metallic Structures
Design of tanks. Elevated tanks. Bunker and Silos. Design of guyed towers and self-supporting towers .Transmission towers. Space and long span roofs.

07 04 634 Design of Thin Walled Steel Structures
Classification of elements; properties of sections, allowable design stresses, effective width of compression elements, design of axially loaded members, beams and beam-columns, design of connections.

07 04 640 Properties and Testing of Materials
Concrete aggregates, properties, selection, optimization and durability of Cement, hydration, heat evolution, special types of cement, chemical and mineral admixtures, classification, physical properties, performance, cost and mechanical properties, Wood, types, properties and testing. Waterproof and heat insulation materials, introduction to polymer.

07 04 641 Specifications of Construction Materials
Egyptian standard specifications. ASTM. B.S.S. comparison between different specifications. Compositions of construction materials.

07 04 642 Special Types of Concrete
Properties and strength of light weight concrete. Fibrous concrete. Massive concrete. Pre-stressed concrete. Pre-cast concrete and heavy weight concrete.

07 04 643 Inspection, Quality Assurance and Control
Test procedures. Sampling methods. Data collection and statistical data distributions. Quality control charts. Development of quality assurance. Specifications and acceptance plans. Examples using data from actual field of construction and laboratory experiments collected by destructive and non-destructive methods. Inspection and testing of construction materials. Inspection before, during, and after construction.

07 04 644 Production of Engineering Materials - Fatigue of Metallic Materials and Welding Techniques
Ferrous materials; Raw material of iron, High furnace, Production of raw cast iron, Transforms,- Production of sponge iron by direct reduction, Processes of continuous casting,- Rolling process, Extraction and forging- Non-ferrous materials; Raw materials for aluminum, Processes of electrical analysis, melting, aluminum continuous casting, Rolling processes, Raw material for lead, Extraction of lead- Alloys; Extraction processes- Plastics- Examples of other metals.

Types of repeated and cyclic loading - Welding techniques and monitoring - Fatigue limits for common types of welding- Residual stresses and its monitoring. Brittle fracture of steel weld elements- Failure of metals and weld elements under repeated loading- Damage theories for welded and un welded metals- Applications and selection of design parameters- Testing of welds; Welding techniques, methods and non-destructive tests of welds, Residual stresses and its measurements.

07 04 645 Non-Destructive Testing and Experimental Stress Analysis

Non-destructive tests of concrete and metals; hardness testing, steel dedication and others- Visual test; pressure and leak test, liquid penetration test, test by radiography, test by magnetic methods, test by ultrasonic methods and test by eddy current methods - Experimental stresses analysis, structure model analysis, Analogy - Stress analysis by brittle coatings and brittle models and grid methods- Photo elasticity.

07 04 650 Design of Reinforced Concrete Structures – 1

Limit States Method – Strength of concrete under combined stresses – Analysis and design of reinforced concrete members subjected to flexure – Eccentric compression – Shear and Torsion – Bond and anchorage – Serviceability limit state: deflection and crack control – Yield Line analysis of slabs.

07 04 651 Pre-stressed Concrete – 1

Methods of pre-stressed. Properties of materials used in pre-stressed concrete. Pre-stress losses .Analysis and Design of sections subjected to bending moment and shear forces cracking and Ultimate loads. Composite beams.

07 04 652 Space and Shell Structures

Introduction, Loading, Membrane theory for surfaces of revolution
Cylindrical Shells: membrane theory, bending theory for closed circular cylindrical surfaces subjected to ax symmetrical loading, bending theory for open circular cylindrical surfaces .Circular cylindrical shell roofs continuous in the transverse direction - Circular cylindrical shell roofs continuous in the longitudinal direction .Applications on different shell problems.

07 04 653 Design of RC Structures for Earthquake Resistance

Introduction, Ground Conditions and Seismic Action. Characteristics of Earthquake resistant buildings. Structural Analysis, Specific Rules for Concrete Buildings: Design concepts, Design according to Egyptian Code, Provisions for anchorage and splices Concrete Foundation Elements.

07 04 654 Inspection, Assessment, Repair and Strengthening of Reinforced Concrete Structures

Defects, Methods of inspection, Assessment of Reinforced concrete Structures, Reasons for Repair and/or Strengthening, Methods of repair or Strengthening of RC structures .Non-Conventional Methods of repair or strengthening, Analysis of RC sections after strengthening.

0704655 Introduction to reinforced concrete tall buildings

Introduction – analysis and design of tall buildings containing symmetrically and unsymmetrically placed shear walls – design of shear walls with openings – design of box structures – evaluation of the different systems used in tall buildings.

07 04 660 Conditions of Contracts for Works of Civil Engineering Construction (FIDIC)

General conditions. Definitions and interpretation. Engineer and engineer's representative. Assignment and subcontracting. Contract documents. General obligations. Labor. Materials, plant and workmanship. Suspension. Commencement and delays. Defects liability. Alterations, additions and omissions. Procedure for claims. Contractor's equipment, temporary works and materials. Measurement. Provisional sums. Nominated subcontractors. Certificates and payment. Remedies. Special risks. Release from performance. Settlement of disputes. Notices. Default of employer. Changes in cost and legislation. Currency and rates of exchange.

07 04 661 Productivity Improvement in Construction Projects

Production process improvement. Work task analysis. Recording techniques. Work measurement. Field count. Theory of activity sampling. Estimating and tendering. Parties involved in estimating and tendering. The estimates process. Tendering adjustments. Submitting the tender. Workforce motivation. Cost control. Allocation of cost. Materials control. Subcontractors.

07 04 662 Computer Applications in Construction Management

Primavera Project Planner (P3). Creating projects and layouts. Working with activities and relationships. Activity and resource calendars. Defining project dictionaries. Calculating and adjusting the schedule. Targets and progress. Resource management. Project groups. Project tools. Customizing views. Grouping, sorting, filtering, and summarizing data. Printing layouts, reports, and graphics.

07 04 663 Construction Engineering

Overview of the construction industry. Earthmoving machinery and properties. Excavation and lifting. Loading and hauling. Compaction and finishing. Concrete construction. Concrete form design.

07 04 664 Management of Construction Companies

Company organization. Market planning and business development. The business development strategy. The business forecast. Company strengths and weaknesses, international construction logistics. Information resources. Process involved in construction business, management of contractor' information resources. Financial management. Capital sources. The company accounts. Analysis of the balance sheet. Inflation accounting.

07 04 665 Linear programming principals in construction projects

A two-variable model and its graphical solution, linear programming (LP) formulations, additional linear programming formulations, overall idea of the simplex method, development of the simplex method, primal simplex method, dual simplex method, special cases in simplex method application, interpreting the simplex tableau: sensitivity analysis, mathematical foundations, revised (primal) simplex method, definition of the dual problem, solution of the dual problem, economic interpretation of the dual problem, complementary slackness, post-optimal or sensitivity analysis, parametric linear programming, definition and application of the transportation model, solution of the transportation problem.

07 04 666 Introduction to equipment and construction methods.

Fixed-position excavation machines, methods of transportation materials, specialized excavation machines, simple lifting mechanisms, cranes, truck, tower cranes, fork-lift truck, monorail, concrete pump, aggregate production, concrete production, pre-stressed concrete, flexible pavement construction, bituminous based materials for flexible pavements, concrete pavement construction, soil-stabilized pavement construction, welding technology, bridge construction methods.

07 04 667 Economic Feasibility study of construction projects.

Interest calculations, simple interest, cash flow diagrams, compound interest, nominal and effective interest rates, present worth, uniform series of payments, equivalence, uniform gradient series, economic feasibility, traditional methods of appraisal, the equivalent annual cost method, the present worth method, capitalized costs, internal rate of return method, influences on economic analysis.

07 04 668 Introduction to Stability of Structures

Introduction and terminology; mathematical models; Stability of columns in elastic and plastic domains; Beam-columns; Stability functions; torsional buckling, flexural-torsional buckling; lateral buckling of beams.

07 04 710 Stability of Structures -1

Introduction and scientific terms, mathematical models, stability of column in elastic and plastic state, stability function, torsional buckling, later buckling of beams.

07 04 711 Theory of Elasticity

Stress and strain tensor; principal stresses and invariants of stress tensor; stress deviation tensor and its invariants; octahedral stresses. Mohr's circles for three dimensional stress system; equations of equilibrium; equations of compatibility. Linear elastic isotropic stress-strain relation (hook's law); plane stress case; plane strain case; principle of virtual work. Stress function; applications: effect of circular holes on stress distribution in plates, Saint Venant problems, two dimensional

07 04 712 Plastic Analysis of Structures

Basic concept of plastic analysis; plastic hinge formation; collapse mechanism. Step-by-step method; load-displacement relationship. Static, kinematics, and uniqueness theorems; partial, complete and over-complete collapse mechanisms; method of combining mechanisms; deflection at collapse. Cyclic loading and shake-down theorem; analysis of rectangular and circular plates.

07 04 713 Structural Analysis of Plates & Shells

Assumptions; formulation of governing equations for rectangular plates subjected to normal and in-plane loads. Solutions of rectangular plates with different edge conditions; continuous rectangular plates; plates of various shapes. Thermal stresses in plates; large deflection and buckling of thin plates. Various types of shell structures; assumptions; stress-strain relations; strain-displacement relations. Internal actions; fundamental membrane theory of thin shells; boundary conditions; analysis of cylindrical shells; shells of double curvature; edge disturbance.

07 04 714 Structural Dynamics I

Types of dynamic loads and formulation of the equation of motion. Free and forced vibration of single-degrees of freedom (SDF) systems. Free vibration of multi-degrees of freedom (MDF) systems. Forced vibration of MDF systems. Response of MDF systems to gusting wind and earthquakes.

07 04 715 Structural Dynamics II

Non-classical modal analysis. Fourier analysis. Random vibration; response of single-degree of freedom systems to random load. Distributed random loads. Response of multi-degrees of freedom systems to random loads. Nonlinear vibration.

07 04 716 Analysis of Composite Structures

Analysis of composite sections. Analysis of composite beam-columns under long term loading. Analysis of simple and continuous composite beams. Partial interaction theory

of simple and continuous composite beams. Effect of slip and uplift at the interface of concrete slab steel beams. Types of composite connections and their analysis.

07 04 717 Finite Element I

Matrix algebra; finite difference method. Weighted residual methods; fundamental concepts of finite element method. Structure idealization and discretization; selection of approximating (shape) functions. Deriving the element equation: direct approach and variation approach. Higher order finite element; mapping and numerical integration. Formulation of two and three dimensional problems. Plane stress and plane strain problems; axi-symmetrical problems. System equation; boundary conditions; solving techniques. Computer applications on different structures.

07 04 718 Nonlinear Analysis of Structures I

Sources of nonlinearity; levels of structural analysis; coordinate systems. Equilibrium check; Lagrangian and Eulerian approaches. Solution of nonlinear problems: incremental and iterative solution techniques. Tracing of equilibrium path beyond limit and bifurcation critical points. Automation of load increments. Convergence criteria.

07 04 719 Inelastic Seismic Performance and Damage Evaluation of Building Structures

Modeling various structural systems; Evaluating global strength and ductility of various structural systems under pushover static loading; Assessing the local performance of individual structural elements and determining the effect of the geometric nonlinearity; Evaluating local damage of individual elements and of global damage of whole structural system using damage indices.

07 04 720 Geo-environmental Engineering

Geo-technical practice for waste disposal. New disposal Facilities: landfills, clay liners, geo-membrane liners , collection, and removal system, stability of landfills. Remediation Technologies: strategies for remediation, geophysical techniques for subsurface site. Soil exploration at contaminated sites, vertical cutoff walls, cover system, Recovery well system, in situ bioremediation of ground water, soil washing. Monitoring Wells vadose Zone Monitoring.

07 04 721 Buried Structures and Tunnels

Calculation of loads acting on buried structures of different shapes and flexibility due to own weight of soil, live, and moving loads. Design loads. Method of construction and excavation. Effect of construction method on the adjacent buildings.

07 04 723 Soil Dynamics

Theory of vibration. Wave propagation in systems of an elastic homogeneous isotropic medium. Elastic waves in layers. Propagation of waves in saturated soil. Behavior of dynamically loaded soil. Theory of vibration of foundations.

07 04 724 Earth Retaining Structures
Introduction - Materials and manufacture - Hydraulic design loads and stresses - Design considerations - Durability considerations - Design for sulfide control - Standards and testing - Slurry walls - Reinforced earth.

07 04 725 Deep Foundations
Elastic behavior of axially and laterally loaded piles and piers - Ultimate bearing capacity of single piles and pile groups subjected to axial loading - lateral loading and inclined loading - Driving stresses and formula - Inspection and testing of piles after installation - Deep foundation in difficult subsoil conditions.

07 04 726 Theoretical Soil Mechanics
Stress – Strain behavior of soil. Stress path concept - Critical state of soil mechanics. Shear strength of soil - Flow of water through soil**.**

07 04 727 Soil Instrumentation and Field Testing
Theory of wells - Construction of wells - Observation wells and pumping wells – Inclinometers - Plate loading test - Penetrometers: static and dynamic – Piezocone – Pressuremeter.

07 04 728 Rock Mechanics and Tunneling Engineering – 2
Definition - Rock formation - Physical properties and laboratory tests - Mechanical properties and their measurements - Field `tests - Stress under surface loading - Lateral rock pressure - Stability of cuts - Site investigations - Foundation resting on rock - Types of tunnels - Geological investigations - Earth/rock pressure on tunnels - Planning of tunnels - Specifications and design construction methods.

0 7 04 730 Stability of Structures II
Buckling of columns on elastic foundations. Stability of frames; stability of plates in elastic and plastic domains. Stability of arches and rings; stability of shells.

07 04 731 Metallic Space Structures
Analysis of space structures. Types of loads acting on space structures. Design of sections and connections of space structures. Methods of construction.

07 04 732 Metallic Tall Buildings

Construction methods of tall buildings. Types of loads acting on tall buildings. Structural systems of tall buildings. Approximate methods of analysis for tall buildings. Behavior of buildings under the effect of vertical and horizontal loads. Design of connections and wind bracing systems.

07 04 733 Optimum Design of Steel Structures

General formulation of optimal design. Approaches to structural design optimization . Optimality criteria method . Linear, nonlinear, and dynamic programming. Applications in the optimization of steel structures.

07 04 734 Cold Formed Structures

Theory of thin walled sections. Design of sections subjected to axial and combined axial and bending forces. Design of connections and bracing. Methods of construction.

07 04 735 Ultimate Strength Design of Metallic Structures

Design of trusses using the ultimate strength method - Design of beams and frames - Design of connections - Comparative study for the methods of design in metallic structures.

07 04 736 Design of Special Metallic Structures-2

Design of tanks - Elevated tanks - Bunker and Silos - Design of guyed towers and self-supporting towers.

07 04 737 Analysis and Design of Steel Towers

Shapes: guyed, transmission towers - Loadings: vertical loading, wind loading and wire loading - Temperature effects; mast; guys; fasteners; foundation - Linear analysis; nonlinear analysis; buckling strength; design formula - Fabrication; erection.

07 04 738 Advanced Structural Analysis and computer applications-2

Analysis of structures in three dimensions - stiffness method for analyzing 3D structures - methods of dynamic analysis - computer applications.

07 04 739 Analysis and Stability of Suspended Structures-1

Introduction; definitions; shapes of suspended structures; structural behavior of cables; static analysis; introduction to Nonlinear analysis and stability; introduction to Performance under wind and earthquake loading; methods of design and erection.

07 04 740 Time Dependent Properties and Failure of Hardened Concrete

Concrete behavior under uniaxial, biaxial, and triaxial stresses in tension and compression. Shrinkage of concrete, creep of concrete, creep of prestressed concrete, relaxation of steel stress in prestressed concrete.

07 04 741 Concrete Technology
Hot weather concreting. Massive concrete. Effect of volume change on cracks of massive concrete. Concrete testing in existing structures. Design of mixes for normal, and heavy weight concrete. Admixtures for concrete. Evaluation of strength test results of concrete. Selection and use of aggregates for concrete. Structural Composite materials. Refractory concrete materials.

07 04 742 Deterioration of Construction Materials and Materials of Repair
Durability of concrete. Corrosion of steel. External influences on concrete. Chemical attacks. Assessing concrete damage. Diagnosis of building. Methods of repair (dry-pack method, concrete replacement method, mortar, use of epoxy). Protection of steel reinforcement against corrosion. Case study for the use of repairing materials.

07 04 743 Non-Destructive Testing and Experimental Stress Analysis
Non-destructive tests of concrete and metals hardness testing, steel dedication and others. Visual test. Pressure and leak test. Liquid penetration test. Test by radiography. Test by magnetic methods. Test by ultrasonic methods. Test by eddy current methods. Experimental stresses analysis: structure model analysis. Analogy. Stress analysis by brittle coatings and brittle models. Grid methods. Photo elasticity

07 04 744 Corrosion Theories of Metallic Materials
Theory of galvanic cells. Properties of corroded metals. Fatigue corrosion and creep stresses. Crack diffusion in metals subjected to corrosive media. Design limit of metals in corrosive cells. Application: pressure vessels, chemical settlers, reinforced steel bars. Protection and prevention method. Cathodic protection concept. Corrosion tests and monitoring.

07 04 745 Durability of Concrete
Design of concrete mixes for durability. Permeability of concrete and factors affecting it. Determination of permeability coefficient: organic and inorganic acid attack. Effect of sulfates on concrete. Effect of chlorides on the durability of concrete. Effect of sea water on concrete. Corrosion of steel reinforcement and its protection. Choice of aggregate and type of cement for durability under severe conditions. Freezing and thawing of concrete in cold weather, Alkali reaction of aggregate.

07 04 746 Introduction to Fracture Mechanics
Cohesive strength, plasticity, Fracture mechanics in relation to structure steel, Stress intensity, Fracture toughness, Energy release rate, LEFM , COD, J- integral , R-curve, fatigue, compressive fracture of concrete, , Masonry and rocks; cracking patterns , fracture theories, damaged models, test methods and effects.

07 04 747 Construction Technology

Concrete casting; of high-rise building, in moving water- Formwork: Concrete pressure, ACI equation, tunnel formworks, slip-form and design- Construction methods; pre-stressed concrete, pre-cast concrete and steel construction – welding.

07 04 748 Inspection and Quality Control-2

Definition of quality and quality assurance according to Egyptian code- Variables and attributes - Different charts of quality control - Quality control of building materials.

07 04 749 Self Compacting Concrete and High Performance Concrete-1

Self-compacting concrete; Definitions, Materials, Admixtures, Tests, properties and design of concrete mixes - High performance concrete - Mineral admixtures; Properties, Applications.

07 04 750 Design of Reinforced Concrete Structures -2

Limit States Method – Strength of concrete under combined stresses – Analysis and design of reinforced concrete members subjected to flexure – Eccentric compression – Shear and Torsion – Bond and anchorage – Serviceability limit state: deflection and crack control – Yield Line analysis of slabs.

07 04 751 Pre-stressed Concrete -2

Methods of pre-stressing – Properties of materials used in prestressed concrete – Pre-stressing losses – Analysis and Design of sections subjected to bending moment and shear forces – Cracking and Ultimate loads – Composite beams – Study of end anchorage zone – Statically indeterminate structures.

07 04 752 Analysis and Design of Tall Concrete Buildings

Introduction – Analysis and design of tall buildings containing symmetrical and asymmetrically distributed shear walls. Design of shear walls containing openings, Design of tubular structures, Evaluation of these methods.

07 04 753 Mechanics of Concrete Structures

Modes of failure under multi-axial stresses. Nature of bond and distribution of stresses between cracks. Representation of concrete structures by the finite element. Methods to study the behavior of reinforced concrete members Elastic and plastic buckling for element subjected to concentric and Eccentric loads.

07 04 754 Reinforced concrete shell structures – 2

Introduction – loads – membrane theory – cylindrical shells: membrane theory, bending theory for axi-symmetrically loaded closed cylindrical surfaces and bending theory for

open cylindrical surfaces – cylindrical shells continuous in the transverse direction - cylindrical shells continuous in the longitudinal direction – examples

07 04 755 Seismic design of reinforced concrete structures -2
Introduction – movement of tectonic plates and nature of earthquakes – specifications of earthquake resisting structures – Structural analysis – reinforced concrete tall buildings: design principals, design according to Egyptian code – splices and curtailment of reinforcement - foundations

07 04 756 Inspection, evaluation, repair and strengthening of reinforced concrete structures-2
Introduction – faults and damage – inspection methods – evaluation methods for reinforced concrete structures – aims of repair and strengthening – methods of repair and strengthening of reinforced concrete structures – modern methods for repair and strengthening – analysis of strengthened reinforced concrete sections

07 04 757 Introduction to Seismic Analysis of structures
Definitions; General characteristics of earthquake ground motion; earthquake risk; seismic design principles; Deterministic analysis of earthquake response; governing equations, linear elastic and inelastic response; introduction to design response spectra; parameters affecting seismic behavior of structures; Introduction to probability theory and Fourier analysis; Non-deterministic earthquake analysis.

07 04 758 Introduction to Analysis of Space and Non Conventional Structures
Definitions; Introduction to different methods for analyzing space structures to calculate imternal forces; Loads on space structures; design of sections and connections of space structures.

07 04 760 Linear Application Program in Civil Engineering
Definition of linear program, graphic solution and simplex method, application of linear program in structural engineering and project management. Methods of solution and application.

07 04 761 Risk Management, Insurance and Licensing
General introduction in law. Laws for labor in Egypt. Insurance laws for building. Taxation laws concerning contracting companies and consulting services. Building regulations. Legal responsibilities for building construction. Principles of accounting. Applications to construction industry. The bidding process and bidding requirements. Principles and basics of construction contracting. Types of construction contracts. Selection of construction contracts. Contracts documents. Project delivery systems.

Introduction to building and construction law. Legal aspects associated with construction projects.

07 04 762 Quality Control in the Construction Process
Introduction to quality. Quality improvement techniques. Fundamentals of statistics and probabilities. Control charts for variables and attributes. Lot-by-lot acceptance sampling by attributes. Acceptance sampling systems. Reliability. Cost of poor quality. Total quality management. Computers and quality control.

07 04 763 Shallow Foundations
Beams on elastic foundations. Plates and rafts on elastic foundations. Beams and plates resting on non-homogeneous soil. Shallow foundations in difficult sub-soil conditions.

07 04 764 Claims, Liability and Dispute Resolution
Contract changes. Major claim categories. Design changes, additions and deletions. Changed site condition. Delay claims. Acceleration effect on claims. Pricing delay claims. Pricing acceleration, impact and effect, and ripple effect claims. Alternative dispute resolution. Text of the contract guidelines for the disputes resolution clause.

07 04 765 Construction Productivity.
Introduction, techniques for measuring, human factors and productivity improvement, management issues

07 04 766 Time delay disputes in construction contracts.
Definitions – causes – types - methods description and implementation - analysis evaluation - professional methodology.

07 04 767 Computer Applications in Civil Engineering Projects.
Using Primavera Enterprise (P6) - Creating projects and layouts - Working with activities and relationships - Activity and resource calendars - Defining project dictionaries - Calculating and adjusting the schedule - Targets and progress - Resource management - Project groups - Project tools - Customizing views - Grouping, sorting, filtering, and summarizing data - Printing layouts, reports, and graphics.

07 04 768 Construction Management.
Integration – Scope, time, cost, quality, human resources, communication, risk, procurement and stakeholder.

07 04 769 Management Techniques of Construction Companies.
Company organization - Market planning and business development - The business development strategy - The business forecast - Company strengths and weaknesses -

international construction logistics - Information resources - Process involved in construction business - Management of contractor' information resources - Financial management - Capital sources - The company accounts - Analysis of the balance sheet - - *Inflation accounting.

07 04 770 Value Engineering in the Construction Industry.
The value concept: history, definitions, application to the construction industry, incentive provisions in construction contracts, factors to be considered, application to design. Value engineering methodology: information phase, speculative phase, analytical phase, proposal phase, and final report phase. Value engineering study procedures: objective, selecting the input required, required documentation, life cycle cost methodology including weighted evaluation.

07 04 771 Construction Equipment and Methods.
Calculation of equipment cost - Predicting equipment productivity - Fixed-position excavation machines - Methods of transportation materials - Specialized excavation machines - Simple lifting mechanisms – Cranes, truck, tower cranes, fork-lift truck, monorail, concrete pump - Aggregate production - Concrete production - Pre-stressed concrete - Flexible pavement construction - Bituminous based materials for flexible pavements - Concrete pavement construction - Soil-stabilized pavement construction - Welding technology - Bridge construction methods.

07 04 772 Feasibility study of civil engineering projects.
Technical study - Economical study and Financial study - Simple interest - Cash flow diagrams - Compound interest - Nominal and effective interest rates - Present worth - Uniform series of payments – Equivalence - Uniform gradient series - Economic feasibility - Traditional methods of appraisal - The equivalent annual cost method - The present worth method - Capitalized costs - Internal rate of return method - Influences on economic analysis.

07 04 810 Analysis of Space and Non-conventional Structures
Introduction; shapes; economy; materials; cables systems. Structural behavior; element stiffness matrices; transformation matrices. Suspension bridges; cable-stayed bridges; continuous suspension bridges. Lattice shells and lattice domes; air-supporting structures. Deployable structures; fabric and cable net structures. Applications using structural-analysis computer programs.

07 04 811 Inelastic Seismic Performance and Damage Evaluation of Building Structures
Modeling various structural systems including; moment-resisting steel frames, concentrically and eccentrically braced steel frame, moment-resisting RC frames and RC

shear walls using computer programs of inelastic dynamic analysis. Evaluating global strength and ductility of various structural systems under pushover static loading and real earthquake records. Assessing the local performance of individual structural elements and determining the effect of the geometric nonlinearity (P-Δ). Evaluating local damage of individual elements and of global damage of whole structural system using damage indices. Applications on capacity-design and seismic rehabilitation.

07 04 812 Wind Engineering

Nature of wind; wind measurements. Characteristics of the atmospheric boundary layer; variation of mean wind speed with height. Turbulence characteristics; turbulence intensity. Power spectrum of strong winds; probability analysis of extreme wind; design wind speed in Egypt. Wind response of structures; stochastic approach; time domain approach; design implications; gust factor; code requirements. Fundamentals of aeroelasticity; wind effects on bridges (divergence, vortex shedding); flutter and galloping.

07 04 813 Seismic Analysis of Structures

General characteristics of earthquake ground motion; characteristics of some typical strong earthquakes; earthquake risk in Egypt; seismic design principles. Deterministic analysis of earthquake response: governing equations, linear elastic response, inelastic response, design response spectra. Code requirements; parameters affecting seismic behavior of buildings. Introduction to probability theory and Fourier analysis. Non-deterministic earthquake analysis; stochastic modeling of strong ground motions; analysis of linear systems; spectral analysis in time domain and frequency domain. Multi component effects of earthquakes.

07 04 814 Analysis and Stability of Suspended Structures-2

Advanced systems in suspended structures; Advanced materials used in suspended structures field; structural behavior of cables and its types; static analysis; stability and non linear analysis; performance under wind and seismic loads.

07 04 820 Limit Analysis of Soil Problem

Upper bound method. Lower bound method. Slip line method. Theory of punching. Progressive failure. Applications of limit analysis in soil problems: earth pressure, stability of slopes, and bearing capacity of footing – soil system.

07 04 821 Geotechnical Earthquake Engineering

Elements of structural dynamics. An outline of the nature and characteristics of earthquake. Strength and deformations of structural materials and elements under loads similar to seismic loads. Effect of some previous created earthquakes. Determination of seismic loads. Probability theory methods in problems of seismic resistance.

07 04 822 Advanced Numerical Methods for Solving Soil Problems
Method of finite element: seepage problems, two-dimensional and three-dimensional elasticity problems, elasto-plastic problems - Application of boundary element and finite element in soil problems.

07 04 823 Advanced theoretical soil mechanics
Application of the theory of elasticity in soil problems: stresses in soil, consolidation in two and three dimensions. Settlement analysis and sand drains. Application of the theory of plasticity in soil problems: stability of slopes, bearing capacity of foundations, and earth pressure on retaining structures.

07 04 824 Soil Structures Interaction
Soil foundation interaction: static and dynamic problems of soil structure interaction.

07 04 825 Application of Numerical Methods in Geotechnical Engineering
Introduction to numerical method techniques - Formulation of field differential equations in solving geotechnical problems - Finite difference method and applications - Finite element method and applications - Boundary element method and applications.

07 04 830 Metallic Suspension Structures
Methods of analysis of suspension structures and bridges. Types of loads acting on suspension structures and bridges. Design procedure of suspension structures and bridges. Methods of construction.

07 04 831 Pre-stressed Metallic Structures
Theory of pre-stressed structures. Design of pre-stresses trusses, beams ,and frames. Applications of pre-stressing in metallic structures. Methods of construction.

07 04 832 Plastic Design of Metallic Structures
Plasticity in metallic structures - Plasticity criteria and limits - Applications on the optimum design of steel structures - Design of connections in plastic state.

07 04 833 Design of Special Structures-3
Offshore and moving metallic structures - Types of drilling steel platforms - Supply structures and piers - Methods of construction of drilling platforms - Types of direct and indirect loading acting on offshore and moving structures - Stability of shells and composite connections in offshore structure.

07 04 834 Stability of Structures-3

Buckling of columns on elastic foundations - Stability of frames; stability of plates in elastic and plastic domains - Stability of arches and rings; stability of shells - Lateral buckling of beams.

07 04 840 Value Engineering in the Construction Industry

The value concept: history, definitions, application to the construction industry, incentive provisions in construction contracts, factors to be considered, application to design. Value engineering methodology: information phase, speculative phase, analytical phase, proposal phase, and final report phase. Value engineering study procedures: objective, selecting the input required, required documentation, life cycle cost methodology including weighted evaluation.

07 04 841 Fracture Mechanics

Stress concentration –Transition behavior of different metallic materials - Ductile and brittle fracture – Non-linear fracture mechanics – Material selection for components subjected to cyclic loading – Fatigue damage and cycle counting analysis- Crack growth rate and fatigue life prediction.

07 04 842 Refractory Concrete and Fire Resistance of construction

Over view of structural fire engineering- Fire behavior; heat transfer and structural response of buildings – Major events of structure fire- Comparison of structural fire design approaches in different codes (E.S.S, ACI - British and Euro codes) - Introduction to fire protection engineering; Methods of insulation- Refractory concrete; Materials , properties and usages.

07 04 843 Micro mechanics of Materials

Basic theories - Analysis techniques and mathematical foundations of micromechanics - Physical micromechanics: mathematical theory of dislocation, and cohesive fracture models - Micro-elasticity: Eshelby's eigenstrain theory - Comparison variation principles, and mico-crack/mico-cavity based and damage theory - Theoretical composite material that includes the main methodologies in evaluating overall material properties - Meso-plasticity that includes meso-damage theory, and the crystal plasticity - Homogenization theory for materials with periodic structures.

07 04 850 Design of reinforced concrete structures-3

Strength of concrete subjected to combined stresses – eccentric compression – shear and torsion – bond – deflection and crack control – analysis of slabs using the yield line theory – steel/concrete composite structures – strut and tie model.

07 04 851 Seismic design of reinforced concrete structures -3

Introduction – movement of tectonic plates and nature of earthquakes – specifications of earthquake resisting structures – Structural analysis – reinforced concrete tall buildings: design principals, design according to Egyptian code – splices and curtailment of reinforcement – foundations.

07 04 852 Analysis and design of reinforced concrete tall buildings-2
Introduction – analysis and design of tall buildings containing symmetrically and unsymmetrically placed shear walls – design of shear walls with openings – design of box structures – evaluation of the different systems used in tall buildings.

07 04 853 Mechanics of concrete structures
Failure modes for concrete subjected to multi-axial stresses – nature of bond and stress distribution between cracks – modeling of concrete structures using the finite element method for studying the behavior of reinforced concrete elements – elastic and plastic buckling of members subjected to axial and eccentric loads.

07 04 861 Advanced Computer Applications in Construction Management.
Advanced use of Primavera Enterprise (P6) - Creating projects and layouts - Working with activities and relationships - Activity and resource calendars - Defining project dictionaries - Calculating and adjusting the schedule - Targets and progress - Resource management - Project groups - Project tools - Customizing views - Grouping, sorting, filtering, and summarizing data - Printing layouts, reports, and graphics.

07 04 862 Local and International Contracts in Civil Engineering
General conditions - Definitions and interpretation - Engineer and engineer's representative - Assignment and subcontracting - Contract documents - General obligations – Labor, materials, plant and workmanship – Suspension - Commencement and delays - Defects liability – Alterations, additions and omissions - Procedure for claims - Contractor's equipment, temporary works and materials – Measurement - Provisional sums - Nominated subcontractors - Certificates and payment – Remedies - Special risks - Release from performance - Settlement of disputes – Notices - Default of employer - Changes in cost and legislation - Currency and rates of exchange.

07 04 863 Advanced Construction Engineering and Management.
Advanced overview of the construction industry - earthmoving machinery and properties - excavation and lifting - loading and hauling - compaction and finishing - concrete construction - concrete form design - Quality control - Different construction techniques.

07 04 864 Advanced Mathematical Modeling
Queuing theory, inventory, linear and nonlinear modeling - A two-variable model and its graphical solution - Linear programming (LP) formulations - Additional linear

programming formulations - Overall idea of the simplex method - Development of the simplex method - Primal simplex method - Dual simplex method - Special cases in simplex method application - Interpreting the simplex tableau: sensitivity analysis - Mathematical foundations - Revised (primal) simplex method - Definition of the dual problem - Solution of the dual problem - Economic interpretation of the dual problem - Complementary slackness - Post-optimal or sensitivity analysis - Parametric linear programming - Definition and application of bid strategy - Elements of dynamic programming (DP) model- Definition of the state - Examples of dynamic programming models and computations - Problem of dimensionality in dynamic programming - Solution of linear programs by dynamic programming.

07 04 865 Quality Control Affects in Construction Projects.
Introduction to quality - Quality improvement techniques - Fundamentals of statistics and probabilities - Control charts for variables and attributes - Lot-by-lot acceptance sampling by attributes - Acceptance sampling systems – Reliability - Cost of poor quality - Total quality management - Computers and quality control.

07 04 866 Risk management and uncertainty theories.
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.

07 04 867 Knowledge-Based Systems uses in Construction Management.
Modeling and problem solving - The role of computation in engineering - Knowledge-based systems defined - Knowledge-based systems in engineering - Formulation and representation of problems - State space search - Directed search - Forward and backward chaining - Writing and organizing rules - Architecture of a rule-based system - Semantic nets, frames, and object-oriented programming.

07 04 601 Diploma Project in Structural Engineering

07 04 602 Diploma Project in Construction and Project Management

07 04 701 Master of Engineering Report in Structural Engineering

07 04 702 Master of Engineering Report in Construction and Project Management

07 04 705 Master of Science Thesis in Structural Engineering

07 04 706 Master of Science Thesis in Construction and Project Management

07 04 801 Doctor of Philosophy Dissertation in Structural Engineering

07 04 802 Doctor of Philosophy Dissertation in Construction and Project Management