Master of Science Programs

STATUS REPORT

NOVEMBER 2008
Program Detailed Structure

M.Sc. Program

(D) Structural Engineering
M.Sc. in Construction and Building Engineering
(D) Structural Engineering

## Program Structure

### CORE COURSES:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB 740</td>
<td>Advanced Construction Materials</td>
<td>3</td>
</tr>
<tr>
<td>CB 741</td>
<td>Advanced Structural Analysis</td>
<td>3</td>
</tr>
</tbody>
</table>

Subtotal: 2 Courses * 3 Credit Hours = 6

### ELECTIVE COURSES: GROUP (1)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB 742</td>
<td>Experimental Methods in Civil Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CB 743</td>
<td>Concrete Durability</td>
<td>3</td>
</tr>
<tr>
<td>CB 744</td>
<td>Fiber Reinforced Cementitious Composites</td>
<td>3</td>
</tr>
<tr>
<td>CB 745</td>
<td>Advanced Strength of Materials</td>
<td>3</td>
</tr>
<tr>
<td>CB 746</td>
<td>Advanced design of Reinforced Concrete Structures</td>
<td>3</td>
</tr>
<tr>
<td>CB 747</td>
<td>Advanced Prestressed Concrete</td>
<td>3</td>
</tr>
<tr>
<td>CB 748</td>
<td>Repair of Concrete Structures</td>
<td>3</td>
</tr>
<tr>
<td>CB 749</td>
<td>Bridge Structures</td>
<td>3</td>
</tr>
<tr>
<td>CB 740-S</td>
<td>Finite Element Method</td>
<td>3</td>
</tr>
<tr>
<td>CB 741-S</td>
<td>Theory of Elasticity</td>
<td>3</td>
</tr>
<tr>
<td>CB 742-S</td>
<td>Plastic Analysis and Design of Structures</td>
<td>3</td>
</tr>
<tr>
<td>CB 743-S</td>
<td>Earthquake Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CB 744-S</td>
<td>Design of Special Metallic Structures</td>
<td>3</td>
</tr>
<tr>
<td>CB 745-S</td>
<td>Composite Structures</td>
<td>3</td>
</tr>
<tr>
<td>CB 746-S</td>
<td>Reliability in Civil Engineering</td>
<td>3</td>
</tr>
</tbody>
</table>

Subtotal: 4 Courses * 3 Credit Hours = 12

continued/…
### Elective Courses: GROUP (2)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB 710</td>
<td>Advanced Construction Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CB 711</td>
<td>Value Engineering in the Construction Industry</td>
<td>3</td>
</tr>
<tr>
<td>CB 731</td>
<td>Advanced Geotechnical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CB 762</td>
<td>Design of Hydraulic Structures</td>
<td>3</td>
</tr>
<tr>
<td>CB 758</td>
<td>Highway Materials and Equipments</td>
<td>3</td>
</tr>
<tr>
<td>CB 723</td>
<td>Environmental Impact Assessment of Civil Engineering Projects</td>
<td>3</td>
</tr>
</tbody>
</table>

**Subtotal:** 1 Course * 3 Credit Hours = 3

### Research Thesis:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CB 701</td>
<td>Master's Research Thesis (Part 1)</td>
<td>6</td>
</tr>
<tr>
<td>CB 702</td>
<td>Master's Research Thesis (Part 2)</td>
<td>6</td>
</tr>
</tbody>
</table>

**Subtotal:** 2 Parts * 6 Credit Hours = 12

**Total:** 36
Course Detailed Structure

Course Code : CB 740
Course Title : Advanced Construction Materials
Credit Hours : 3

Course Description

Course Objectives
To familiarize the students with properties, specifications and requirements for special purpose concretes as well as insulating materials.

Course Topics
- Properties and strength of light weight concrete
- Massive concrete, high strength concrete
- Hot weather concrete
- High performance concrete
- Waterproofing materials
- Sound insulating materials
- Advances in concrete technology

References
- American Concrete Institute, “Manual of Concrete Practice,” Parts 1-5, Detroit, USA, 2003.
Course Detailed Structure

Construction and Building Engineering

(D) Structural Engineering

Course Code : CB 741
Course Title : Advanced Structural Analysis
Credit Hours : 3

Course Description

Course Objectives
To present the methods of matrix analysis to the students with emphasis on application to determinate and indeterminate problems.

Course Topics
- Matrix analysis of two-dimensional frames by the stiffness method
- Force and displacement methods
- Formulation of element flexibility and stiffness matrices.
- Temperature effects
- Shear deformation in beams
- Non-linear Structural analysis
- Computer applications

References
Course Code : CB 742
Course Title : Experimental Methods in Civil Engineering
Credit Hours : 3

Course Description
Probability distribution of random variables, data analysis, sampling distribution of means and variances, influence about one mean, difference between two means, comparison of more than two means (ANOVA), randomization block design, factorial design, fractional factorial design.

Course Objectives
To understand the concepts of statistical analysis of data, design experimental programs, and learn the different methods of analyzing data.

Course Topics
- Probability distribution of random variables
- Data analysis and sampling distribution of means and variances
- Influence about one mean, difference between two means, comparison of more than two means (ANOVA)
- Randomization block design, factorial design
- Fractional factorial design

References
Course Code : CB 743
Course Title : Concrete Durability
Credit Hours : 3

Course Description
Design of concrete mixtures for durability, permeability of concrete and factors affecting it, organic and inorganic acid attack of concrete, effect on sulfates on concrete, effect of chlorides on the durability of concrete, effect of sea water on concrete, corrosion of steel reinforcement and its protection.

Course Objectives
To introduce the students with the long-term properties of concrete materials, prevention of deterioration, and sustainability for long term.

Course Topics
- Design of concrete mixtures for durability
- Permeability of concrete and factors affecting it
- Organic and inorganic acid attack of concrete
- 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

References
- American Concrete Institute, “Manual of Concrete Practice,” Parts 1-5, Detroit, USA, 1995.
**Course Code**: CB 744  
**Course Title**: Fiber Reinforced Cementitious Composites  
**Credit Hours**: 3

**Course Description**

**Course Objectives**
To introduce the students to different properties of FRC, their behavior and application. New Developments of FRP are to be targeted.

**Course Topics**
- Fiber reinforcement of cement-based matrices
- Continuous and discontinuous fibers and meshes
- Fiber reinforced concrete and ferro-cement
- Behavior and mechanical properties
- Mechanics of fiber reinforcement
- High strength high performance fiber composites
- Fiber reinforced plastic reinforcement

**References**
- Stevens, D.J., “Testing of Fiber Reinforced Concrete,” American Concrete Institute, Farmington Hills, MI, 1995.
Course Code : CB 745
Course Title : Advanced Strength of Materials
Credit Hours : 3

Course Description
General theory of torsion, nonsymmetrical bending, transverse shear, thin-walled beams, beams on elastic foundations, thick-walled cylinders. Basic contact mechanics. Failure criteria of solids.

Course Objectives
To familiarize the students with the behavior of the materials under various advanced types of loadings as well as failure mechanisms of structure.

Course Topics
- General theory of torsion
- Nonsymmetrical bending
- Transverse shear
- Thin-walled beams, beams on elastic foundations
- Thick-walled cylinders
- Basic contact mechanics
- Failure criteria of solids

References
Course Detailed Structure

Course Code : CB 746
Course Title : Advanced Design of Reinforced Concrete Structures
Credit Hours : 3

Course Description

Course Objectives
To introduce the students to the advanced design concepts of the reinforced concrete structures.

Course Topics
- Inelastic behavior of reinforced concrete beams and columns
- Combined bending
- Shear and torsion in beams
- Behavior of beams, columns, and walls under seismically induced load reversals
- Analysis and design of connections

References
- Building Code Requirements for Reinforced Concrete, ACI 318-04.
Course Code : CB 747
Course Title : Advanced Prestressed Concrete
Credit Hours : 3

Course Description
Prestressing in statically indeterminate structures; design of prestressed concrete slabs; analysis and design of partially prestressed concrete beams; nonlinear analysis; analysis of members prestressed with unbonded tendons; prestressed compression members; special research and/or application related topics.

Course Objectives
To familiarize the students to concepts of analysis and design of indeterminate prestressed concrete structures.

Course Topics
- Prestressing in statically indeterminate structures
- Design of prestressed concrete slabs
- Analysis and design of partially prestressed concrete beams
- Nonlinear analysis
- Analysis of members prestressed with unbonded tendons
- Prestressed compression members
- Special research and/or application related topics

References
- Building Code Requirements for Reinforced Concrete, ACI 318-83.
Course Code : CB 748
Course Title : Repair of Concrete Structures
Credit Hours : 3

Course Description
Concrete behavior: embedded metal corrosion, disintegration mechanics, moisture effects, load effects, concrete evaluation, surface repair, strengthening and stabilization, protection.

Course Objectives
To introduce the students to different causes and methods of repair in reinforced concrete structures.

Course Topics
- Concrete behavior
- Embedded metal corrosion
- Disintegration mechanics
- Moisture effects and load effects
- Concrete evaluation
- Surface repair
- Strengthening and stabilization
- Protection

References
- Krstulovic-Opara, N., “SP-185 High Performance Fiber Reinforced Concrete in Infrastructure Repair and Retrofit,” American Concrete Institute, Farmington Hills, MI, USA, 2000.
Course Detailed Structure

Course Code: CB 749
Course Title: Bridge Structures
Credit Hours: 3

Course Description

Course Objectives
To present the modern approach of bridge design, analyses and health evaluation.

Course Topics
- Advanced concepts and modern trends in design of bridges
- Rehabilitation, repair, and retrofit of existing bridges
- Use of relevant codes
- Study of Alternative structural forms and materials for efficiency and economy
- Design problems and reports

References
- Liu, T.C., “Strength Evaluation of Existing Concrete Bridges,” American Concrete Institute, Detroit, 1985.
Course Code : CB 740-S
Course Title : Finite Element Method
Credit Hours : 3

Course Description
Introduction to the finite element method; Formulation of various finite element stiffness in one, two, and three dimensions; presentation of the principles of modeling and analysis of civil engineering problems using linear, planar, plate, and solid elements; application of the finite element principles to practical problems; introduction to a typical finite element software package.

Course Objectives
To introduce the students to the concepts and methods of finite element analysis of structures.

Course Topics
- Introduction to the finite element method
- Formulation of various finite element stiffness in one, two, and three dimensions
- Presentation of the principles of modeling and analysis of civil structures
- Application to practical problems
- Introduction to a typical finite element software package

References
Course Detailed Structure

Course Code : CB 741-S
Course Title : Theory of Elasticity
Credit Hours : 3

Course Description

Course Objectives
To introduce the students to the concepts and methodologies of elasticity theory.

Course Topics
- Fundamentals of isotropic linear elasticity
- Solution of plane elasticity problems
- St. Venant bending and torsion
- Basic three-dimensional solutions

References
Course Code : CB 742-S
Course Title : Plastic Analysis and Design of Structures
Credit Hours : 3

Course Description

Course Objectives
To introduce the students to the concepts and methodologies of limit state analysis and design of structures.

Course Topics
- Plastic analysis of structural frames
- Rules of practice for the plastic design of steel and reinforced concrete structures
- Design problems and reports

References
Course Code : CB 743-S
Course Title : Earthquake Engineering
Credit Hours : 3

Course Description
Development of a rational basis for design of earthquake resistant design. Engineering characterization of earthquakes; dynamics of inelastic systems; response of inelastic structures; structural system design considerations; modeling and analysis of buildings; performance-based design; an advanced seismic design topic of choice, time permitting. Application of relevant design specifications.

Course Objectives
To introduce the students to the design of structures that would sustain dynamic loading (earthquake forces).

Course Topics
- Engineering characterization of earthquakes
- Dynamics of inelastic systems; response of inelastic structures
- Structural system design considerations
- Modeling and analysis of buildings
- Performance-based design
- Application of relevant design specifications

References
- Ghosh, S., “Earthquake-Resistant Concrete Structures,” American Concrete Institute, Detroit, USA, 1991.
Course Detailed Structure

Course Code : CB 744-S
Course Title : Design of Special Metallic Structures
Credit Hours : 3

Course Description
Design of special steel structures (towers, masts, tanks, etc), torsion of open and box members. Design of tall buildings. Behavior of steel and aluminum structural members is studied with reference to their code design procedures.

Course Objectives
To introduce the students to the design concepts of special steel structures.

Course Topics
- Design of special steel structures (towers, masts, tanks, etc)
- Torsion of open and box members
- Behavior of steel and aluminum structural members
- Code design procedures

References
- Egyptian code requirements for steel structures.
Course Code : CB 745-S
Course Title : Composite Structures
Credit Hours : 3

Course Description
Full interaction of simple and continuous composite beams, types of connections, partial interaction theory of simple and continuous beams, effect of slip and uplift at the interface concrete slab-steel beams, analysis of composite columns.

Course Objectives
To familiarize the students with the advanced concepts of design and analysis of composite structures.

Course Topics
- Full interaction of simple and continuous composite beams
- Types of connections
- Partial interaction theory of simple and continuous beams
- Effect of slip and uplift at the interface concrete slab-steel beams
- Analysis of composite columns

References
Course Code : CB 746-S
Course Title : Reliability in Civil Engineering
Credit Hours : 3

Course Description
The role of risk and probability in Civil Engineering is described and basic probability concepts are presented. Probability distribution functions commonly used to model and analyze Civil Engineering problems are discussed. Methods for estimating parameters and determining distribution models from observational data are introduced. Monte Carlo simulation methods are practiced. Detailed examples of the application of probabilistic methods to structural, transportation, hydrological, and environmental system design are presented throughout the course.

Course Objectives
This course aims to introduce civil engineers to studying reliability and its applications in different fields of civil engineering. A variety of related problems that may evolve in the site is studied and explained.

Course Topics
- Fundamental Concepts related to structural reliability
- Probabilistic treatment of civil engineering systems
- Sample statistics, parameter estimation, and confidence intervals
- Test if a distribution fits sampled data
- Regression analysis

References