COLLEGE OF ENGINEERING
AND TECHNOLOGY

( Graduate Studies )

Master of Science Programs

STATUS REPORT

NOVEMBER 2008
Program Detailed Structure

M.Sc. Program

(A) Construction Engineering and Management
# M.Sc. in Construction and Building Engineering

## Program Structure

### M.Sc. in Construction and Building Engineering

**(A) Construction Engineering and Management**

## Core Courses:

<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 712</td>
<td>Advanced Construction Management</td>
<td>3</td>
</tr>
</tbody>
</table>

**Subtotal**: 3 Courses * 3 Credit Hours = 9

## 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 713</td>
<td>Construction Equipment Management</td>
<td>3</td>
</tr>
<tr>
<td>CB 714</td>
<td>Advanced Systems Analysis for Construction Engineers</td>
<td>3</td>
</tr>
<tr>
<td>CB 715</td>
<td>Special Topics in Concrete Construction</td>
<td>3</td>
</tr>
<tr>
<td>CB 716</td>
<td>Estimating, Tendering and Contracting in Construction</td>
<td>3</td>
</tr>
<tr>
<td>CB 717</td>
<td>Project Planning and Control</td>
<td>3</td>
</tr>
<tr>
<td>CB 718</td>
<td>Financial Management in Construction</td>
<td>3</td>
</tr>
<tr>
<td>CB 719</td>
<td>Construction Economics and Feasibility Studies</td>
<td>3</td>
</tr>
<tr>
<td>CB 710-C</td>
<td>Construction Productivity</td>
<td>3</td>
</tr>
<tr>
<td>CB 711-C</td>
<td>Artificial Intelligence in Construction</td>
<td>3</td>
</tr>
<tr>
<td>CB 712-C</td>
<td>Research Methods in Construction Engineering and Management</td>
<td>3</td>
</tr>
<tr>
<td>CB 713-C</td>
<td>Quality Management in Construction</td>
<td>3</td>
</tr>
<tr>
<td>CB 714-C</td>
<td>Strategic Management in Construction</td>
<td>3</td>
</tr>
<tr>
<td>CB 715-C</td>
<td>Risk Management in Construction</td>
<td>3</td>
</tr>
<tr>
<td>CB 716-C</td>
<td>Human Resources Management in Construction</td>
<td>3</td>
</tr>
<tr>
<td>CB 717-C</td>
<td>Information Technology Applications in Construction</td>
<td>3</td>
</tr>
</tbody>
</table>

**Subtotal**: 4 Courses * 3 Credit Hours = 12

*continued/*…
M.Sc. in Construction and Building Engineering
Program Structure

(A) Construction Engineering and Management

.../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 723</td>
<td>Environmental Impact Assessment of Civil Engineering Projects</td>
<td>3</td>
</tr>
<tr>
<td>CB 731</td>
<td>Advanced Geotechnical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CB 740</td>
<td>Advanced Construction Materials</td>
<td>3</td>
</tr>
<tr>
<td>CB 746-S</td>
<td>Reliability in Civil Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CB 753-T</td>
<td>Geographic Information Systems for Construction Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CB 769</td>
<td>Structures for Integrated Water Resources Management</td>
<td>3</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>1 Course * 3 Credit Hours</strong></td>
<td><strong>3</strong></td>
</tr>
</tbody>
</table>

**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>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>2 Parts * 6 Credit Hours</strong></td>
<td><strong>12</strong></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>36</strong></td>
</tr>
</tbody>
</table>
Course Detailed Structure  
Construction and Building Engineering  
(A) Construction Engineering and Management

Course Code : CB 710  
Course Title : Advanced Construction Engineering  
Credit Hours : 3

Course Description
Advanced topics in the area of construction engineering including underground construction: dewatering systems; shoring systems; and underpinning. Formwork systems in building construction: horizontal formwork; and vertical formwork systems. Cranes works. Belt-conveyor systems. Tunnel construction: driving tunnels in rock, drilling rock, drill jumbos, drilling patterns, and driving tunnels with tunnel-boring machines. Bridge construction: traditional construction; cantilever carriage method; and flying shuttering. Dam construction.

Course Objectives
To provide students with an understanding of advanced topics in the field of construction engineering: building construction; bridge construction; and tunnel construction.

Course Topics
- Underground construction including dewatering systems, shoring systems and underpinning.
- Formwork systems in building construction including horizontal and vertical formwork systems.
- Crane works in construction.
- Belt-conveyor systems.
- Tunnel construction: driving tunnels in rock; drilling rock; drill jumbos; drilling patterns; and driving tunnels with tunnel-boring machines.
- Bridge construction: traditional construction of bridges; cantilever carriage method; and flying shuttering.
- Dam construction

References
Course Detailed Structure  

Construction and Building Engineering  

(A) Construction Engineering and Management  

Course Code : CB 711  
Course Title : Value Engineering in the Construction Industry  
Credit Hours : 3  

Course Description  

Course Objectives  
To provide students with and understanding of the concepts of value engineering and its applications in the construction industry.

Course Topics  
- Value engineering concepts and definitions  
- Value engineering study process and procedures  
- Function analysis  
- Level of abstraction and selection of alternatives  
- Evaluation techniques  
- Presenting value studies  
- Whole life cycle costing  
- Construction case studies and applications

References  
Course Detailed Structure  
(A) Construction Engineering and Management

Course Code : CB 712  
Course Title : Advanced Construction Management  
Credit Hours : 3

Course Description
General characteristics of the construction industry and the general aspects and nature of construction management. Further management and business topics include: strategic management; risk management; human resources management; health and safety in construction; organizational behavior; business performance management; quality management, environmental management and process management.

Course Objectives
To develop an understanding of general management and business topics relating to construction.

Course Topics
- Characteristics of the construction industry
- Aspects and nature of construction management
- Strategic management
- Risk management
- Human resources management
- Health and safety in construction
- Organizational behavior
- Business performance management
- Quality management
- Environmental management
- Process management

References
Course Detailed Structure

(A) Construction Engineering and Management

Course Code : CB 713
Course Title : Construction Equipment Management
Credit Hours : 3

Course Description

Course Objectives
To provide students with the fundamentals of equipment in the construction industry, and to acquaint students with the productivity of the major equipment used in construction.

Course Topics
- Factors affecting the selection of construction equipment.
- Fundamentals of construction equipment
- Construction equipment costs, sizing, operation and maintenance
- Construction equipment productivity
- Applications on excavation, concrete and road pavement equipment
- Evaluation and selection of appropriate construction technology

References
Course Detailed Structure

Course Code : CB 714
Course Title : Advanced Systems Analysis for Construction Engineers
Credit Hours : 3

Course Description

Course Objectives
To provide students with an understanding of optimizing quantitative models and decision-making.

Course Topics
- Modeling and analysis of systems for decision making in construction
- Mathematical programming and sensitivity analysis
- Decision making under uncertainty
- Multi-criteria decision-making
- NP-Hard problems and applications in resource allocations
- Heuristics and near-optimal solutions
- Queuing theory and simulation
- Transportation and assignment problems

References
Course Detailed Structure

Course Code : CB 715
Course Title : Special Topics in Concrete Construction
Credit Hours : 3

Course Description

Course Objectives
To provide knowledge of the construction and design of different formwork systems, and to be acquaint with the construction systems in building construction.

Course Topics
- Design of form work for concrete structures
- horizontal formwork
- vertical formwork
- Analysis of loads, deflections and stresses of formwork systems
- Health and safety in concrete construction.
- Concrete in marine environment
- Hot weather concrete
- Mass concrete
- Ready mix concrete
- Self compacting concrete

References
- Hurd, M. and Hurd, M. K., “Formwork for Concrete”, American Concrete Institute, Detroit, 1995.
Course Detailed Structure

Course Code : CB 716
Course Title : Estimating, Tendering and Contracting in Construction
Credit Hours : 3

Course Description

Course Objectives
To provide students with the knowledge concerned with estimating quantities and costs, the construction tendering process and contractual issues in construction.

Course Topics
- Construction quantity and cost estimation by different contractual parties
- Procurement paths and apportionment of risks
- Tendering process and documentation
- Contractor selection and pre-qualification
- Contract law and forms of contracts in construction
- Sub-contractors and nominated suppliers
- Managing variations in construction contracts – change orders and claims
- Dispute resolution and arbitration

References
Course Code : CB 717
Course Title : Project Planning and Control
Credit Hours : 3

Course Description

Course Objectives
To provide students with advanced knowledge and skills concerned with planning and control of construction projects.

Course Topics
- Advanced planning and scheduling methods in construction
- Resource constrained scheduling, probabilistic scheduling and line-of-balance.
- Cost planning and design of costing systems in construction projects
- Acceleration of construction projects
- Tracking project progress – time and costs
- Forecasting and controlling project cash flows
- Earned-value systems in controlling construction projects

References
Course Detailed Structure

Construction and Building Engineering

(A) Construction Engineering and Management

Course Code : CB 718
Course Title : Financial Management in Construction
Credit Hours : 3

Course Description

Course Objectives
To introduce students to the basics of financial management in construction.

Course Topics
- Basics of accounting: accounting terms; accounting systems and transactions; and compilation of financial statements.
- Reading and understanding financial statements.
- Financial analysis - basic financial ratios for profitability, liquidity, leverage and efficiency.
- Failure / bankruptcy analysis for construction firms.
- Cash flow analysis of construction companies.
- Investor analysis of construction companies.

References
Course Detailed Structure  
Course Code : CB 719 
Course Title : Construction Economics and Feasibility Studies 
Credit Hours : 3 

Course Description 
Introduction to economics of the construction industry: role of industry in the economy; and demand and supply in construction. Introduction to microeconomics of construction firms. Introduction to engineering economics and discounting principles. Economic comparisons and influences on economic analysis. Feasibility studies and construction projects appraisal: cost and benefits analyses; economic evaluation techniques and sensitivity analysis.

Course Objectives 
To provide an understanding of construction economics and feasibility studies.

Course Topics
- Introduction to economics of the construction industry – role of construction in the economy and demand and supply in construction.
- Introduction to the theory of the firm and microeconomics of construction firms.
- Introduction to engineering economics and discounting principles.
- Economic comparisons and influences on economic analysis.
- Feasibility studies and construction projects appraisal – analyses of costs and benefits, economic evaluation techniques and sensitivity analysis.

References
Course Detailed Structure

Course Code: CB 710-C
Course Title: Construction Productivity
Credit Hours: 3

Course Description

Course Objectives
To provide a knowledge of the productivity concepts and in the construction industry.

Course Topics
- Productivity engineering and management
- Factors of productivity
- Productivity measurement methods
- Total productivity model
- Optimum allocation of resources
- Productivity improvement techniques

References
Course Detailed Structure

Course Code : CB 711-C
Course Title : Artificial Intelligence in Construction Engineering
Credit Hours : 3

Course Description

Course Objectives
To provide an introduction to the basic principles, techniques, and applications of Artificial Intelligence (AI) in the field of construction engineering and management. Upon successful completion of the course, students will have an understanding of the basic areas of AI and their applications in design and implementation of AI for a variety of tasks in analysis, design, and problem solving.

Course Topics
- Overview – Introduction to AI
- Fuzzy set theory and mathematics
- Fuzzy rule-based systems
- Applications
- Evolutionary Algorithms (EA): an Introduction
- Basic EA operations, Overview of different Algorithms
- Applications
- Expert Systems: an introduction
- Applications
- Neural Networks: an introduction
- Back-propagation
- Applications

References
Course Detailed Structure

Construction and Building Engineering

(A) Construction Engineering and Management

Course Code : CB 712-C
Course Title : Research Methods in Construction Engineering and Management
Credit Hours : 3

Course Description
The nature of research methods in construction engineering and management are discussed. Formulation of the research problem. Reviewing literature and technical writing. Design of research methodology and overview of basic research methods. Qualitative and quantitative research methods of data collection and analysis. Overview of statistical methods, modeling techniques, optimization, simulation and IT applications. Methods of research validation and presenting / communicating the research methodology and outcomes.

Course Objectives
To provide an understanding of the main research methods used in construction engineering and management, and develop the necessary knowledge and skills for pursuing research projects, theses or dissertations.

Course Topics
- Nature of construction engineering and management research
- Formulation of research problem
- Literature review and technical writing
- Research methods and research design
- Qualitative research methods
- Quantitative research methods
- Statistical analysis: parametric and non-parametric techniques, regression and factor analysis.
- Advanced statistical topics
- Modeling techniques, optimization, simulation, and IT applications in research
- Research validation
- Communicating research methodology and outcomes to a professional audience

References
Course Detailed Structure  Construction and Building Engineering

(A) Construction Engineering and Management

Course Code : CB 713-C
Course Title : Quality Management in Construction
Credit Hours : 3

Course Description
The history, role and definition of quality in construction leading to the differentiation of the basic quality concepts / approaches. The management of inspection and testing, in addition to process improvement techniques of statistical process control and six sigma. Quality assurance systems with application to ISO 9000:2000 in construction. The implementation of total quality management and the introduction of excellence models. The importance of continuous improvement through effective benchmarking and performance measurement.

Course Objectives
To provide an understanding of the role of quality in construction projects and organizations and the main techniques associated with improving customer satisfaction and quality in construction.

Course Topics
- The history, role and definition of quality in construction
- Differentiating inspection, quality control, quality assurance and total quality management
- Managing inspection and testing in construction
- Process improvement techniques in construction - Statistical process control and six sigma
- Quality assurance systems – ISO 9000:2000
- Total quality management in construction
- Excellence models in construction – EFQM and Baldrige
- Continuous improvement, benchmarking and performance measurement

References
Course Detailed Structure

Construction and Building Engineering

(A) Construction Engineering and Management
Course Detailed Structure

Course Code : CB 714-C
Course Title : Strategic Management in Construction
Credit Hours : 3

Course Description
Introduction to strategic management concepts and process. Types of strategies in organizations. Strategic planning concepts and tools of strategic analysis. Strategic management in the construction context. Strategic performance measurement. Cascading of strategies and development of functional strategies in construction (e.g. human resources and marketing strategies).

Course Objectives
To provide students with knowledge pertaining to strategic management in construction.

Course Topics
- Strategic management concepts and process
- Types of strategies in organizations
- Strategic planning and formulation
- Strategic evaluation and analysis tools and techniques
- Strategic management in a construction context
- Strategic performance measurement
- Functional strategic management in construction

References
Course Detailed Structure

Course Code : CB 715-C
Course Title : Risk Management in Construction
Credit Hours : 3

Course Description

Course Objectives
To provide students with the fundamentals of risk management in construction.

Course Topics
- Principles of risk management: risk management theory; definitions and terms; and the risk management process
- Types of organizational and project risks in construction
- Risk identification, assessment, quantification and prioritization of risks
- Risk reduction and insurance
- Managing the risk management process
- Risks in different parties of the construction project: client; contractors; and consultants
- Practical aspects of implementing risk management (e.g. risk registers)

References
Course Code : CB 716-C

Course Title : Human Resources Management in Construction

Credit Hours : 3

Course Description

Course Objectives
To provide students to the basics of managing human resources in construction.

Course Topics
- Human resources management theory and concepts
- Strategic and operational human resources management in construction
- Construction work design and selection practices
- Training and development
- Performance evaluation
- Workforce diversity
- Work/life balance and employee welfare
- Employee relations and employee empowerment
- Health and safety issues in human resources
- Employment laws.

References
Course Detailed Structure

Course Code : CB 717-C
Course Title : Information Technology Applications in Construction
Credit Hours : 3

Course Description

Course Objectives
To introduce students to the modern methods of information technology (IT) and its applications in construction.

Course Topics
- Construction and office management applications
- Database management and information systems in construction
- Internet based applications in construction – use of web publishing, intranets and E-Commerce in construction
- Knowledge management in construction
- Artificial intelligence and expert systems
- Neural networks
- Optimization packages and genetic algorithms
- Software development – programming principles, programming phases and steps, verification and validation of software / programs, principles of algorithm design and data structures

References