GRADUATE STUDIES:

(Addendum)

Master of Engineering Programs

(M.Eng.)

2009
OVERVIEW

Construction is one of the largest nation's industries, encompassing an incredibly wide range of activities, from high-rise buildings construction to homes, from highways to power plants. Indeed modern construction projects have become so large, complex, expensive and time-consuming that special educational programs now are being offered to prepare students for entry into this important and challenging industry.

The mission of the Construction and Building Engineering Department at the AASTMT is to provide the educational, research, and training programs that serve both the needs of our students and those of the construction industry. The curriculum objective is to prepare individuals for a professional career in construction engineering and management and for continued learning through post-graduate education or self study.

The department offers a B.Sc., a diploma, and a Master's degree in Construction Engineering. As a student in construction engineering, you will learn to identify the best methods and techniques of construction, to determine construction costs and set schedules, to apply methods of quality control and to supervise construction projects.

The program is designed to prepare our students to become outstanding construction engineers, whose job is to devise and design construction facilities, coordinate and direct the efforts of labor and equipment, and control the time and cost demands of field operations.

As they gain experience, construction engineers become construction managers who combine engineering, management, and field construction skills in the administration and management of field construction.

Graduates of the Construction and Building Engineering degree program design and manage construction processes that create living and working environments such as office buildings, industrial buildings, airports, housing, roads, bridges, utilities, and dams. Graduates fill positions in construction companies, engineering consulting firms, government agencies, and large construction corporations. The positions usually involve the planning, design, and management of the construction process for a general, specialty, or mechanical contractor, or the coordination, inspection, and management of design, contracts, or facilities for a business, industry or government owner.

When you ask top managers in construction and engineering firms why they selected this career, you can hear the excitement of the construction industry in their responses. Some say they like to conceive an idea and then engineer and manage it through to reality. Others say that they like the combination of computerized planning, process design, cost engineering, and scheduling with the gratification of seeing a job well done.

Graduates of this degree program enjoy a wide range of opportunities to apply their technical knowledge with tremendous variety in the day-to-day work. Some choose design, planning, or financial management positions working in an office environment, while others prefer to direct field operations or some combination of the above.
Program Detailed Structure
The courses of M.Eng. in Construction and Building Engineering are divided into the following 4 groups:

- **(A) Construction Engineering and Management**
- **(B) Environmental, Water Resources and Coastal Engineering**
- **(C) Geotechnical and Transportation Engineering**
- **(D) Structural Engineering**

All courses are elective. To earn the M.Eng. degree, a student must take a total of at least 10 courses (equivalent to 30 credit hours) in addition to an Applied Research (equivalent to 6 credit hours). The student can choose any number of courses from one (or more) group(s). If the student takes six (or more) courses from one group, this group will be the concentration area of his/her M.Eng. degree.

### (A) Construction Engineering and Management Group

#### Elective 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>
<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 713-C</td>
<td>Quality 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>
<tr>
<td>CB 718-C</td>
<td>Health and Safety in Construction</td>
<td>3</td>
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(B) Environmental, Water Resources and Coastal Engineering Group

**ELECTIVE COURSES:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>CB 720</td>
<td>Water Quality Management and Waste Water Treatment</td>
<td>3</td>
</tr>
<tr>
<td>CB 721</td>
<td>Air Pollution and Indoor Air Quality</td>
<td>3</td>
</tr>
<tr>
<td>CB 722</td>
<td>Management of Solid, Hazardous and Radioactive Waste</td>
<td>3</td>
</tr>
<tr>
<td>CB 723</td>
<td>Environmental Impact Assessment of Civil Engineering Projects</td>
<td>3</td>
</tr>
<tr>
<td>CB 726</td>
<td>Noise Pollution</td>
<td>3</td>
</tr>
<tr>
<td>CB 727</td>
<td>Marine Pollution</td>
<td>3</td>
</tr>
<tr>
<td>CB 729</td>
<td>Energy and Natural Resources Conservation</td>
<td>3</td>
</tr>
<tr>
<td>CB 763</td>
<td>Advanced Hydrology and Climatology</td>
<td>3</td>
</tr>
<tr>
<td>CB 764</td>
<td>River Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CB 768</td>
<td>Water Resources Planning and Management</td>
<td>3</td>
</tr>
<tr>
<td>CB 769</td>
<td>Structures for Sustainable Water Resources Management</td>
<td>3</td>
</tr>
<tr>
<td>CB 763-I</td>
<td>Ocean and Coastal Processes for Project Engineers</td>
<td>3</td>
</tr>
<tr>
<td>CB 764-I</td>
<td>Hydrographic Surveying and Coastal Measurements and Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CB 765-I</td>
<td>Management of Water Resources and Coastal Projects</td>
<td>3</td>
</tr>
<tr>
<td>CB 766-I</td>
<td>Integrated Management of Ports and Coastal Zones</td>
<td>3</td>
</tr>
<tr>
<td>CB 767-I</td>
<td>Port Planning and Development</td>
<td>3</td>
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## Elective Courses:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>CB 731</td>
<td>Advanced Geotechnical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CB 733</td>
<td>Earth Works and Dewatering</td>
<td>3</td>
</tr>
<tr>
<td>CB 736</td>
<td>Foundation on Problematic Soils</td>
<td>3</td>
</tr>
<tr>
<td>CB 737</td>
<td>Piling Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CB 738</td>
<td>Special Geotechnical Structures</td>
<td>3</td>
</tr>
<tr>
<td>CB 733-G</td>
<td>Elastic Analysis of Soil–Foundation Interaction</td>
<td>3</td>
</tr>
<tr>
<td>CB 751</td>
<td>Fundamentals of Traffic Flow Theories</td>
<td>3</td>
</tr>
<tr>
<td>CB 752</td>
<td>Structural Design for Highway and Airport Pavements</td>
<td>3</td>
</tr>
<tr>
<td>CB 753</td>
<td>Transportation Planning and Management</td>
<td>3</td>
</tr>
<tr>
<td>CB 756</td>
<td>Special Topics in Transportation and Highway Engineering</td>
<td>3</td>
</tr>
<tr>
<td>CB 758</td>
<td>Highway Construction and Management</td>
<td>3</td>
</tr>
<tr>
<td>CB 759</td>
<td>Traffic Engineering and Environment</td>
<td>3</td>
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<tr>
<td>CB 752-T</td>
<td>Advanced Construction Surveying</td>
<td>3</td>
</tr>
<tr>
<td>CB 753-T</td>
<td>Geographic Information Systems for Construction Engineering</td>
<td>3</td>
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</tbody>
</table>
M.Eng. in Construction and Building Engineering  
Program Structure

(D) Structural Engineering Group

**ELECTIVE COURSES:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
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</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>
<tr>
<td>CB 743</td>
<td>Concrete Durability</td>
<td>3</td>
</tr>
<tr>
<td>CB 744</td>
<td>Fiber Reinforced Composites</td>
<td>3</td>
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<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>
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<tr>
<td>CB 743-S</td>
<td>Structural Dynamics and Earthquake Engineering</td>
<td>3</td>
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<tr>
<td>CB 744-S</td>
<td>Design of Special Metallic Structures</td>
<td>3</td>
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<tr>
<td>CB 745-S</td>
<td>Composite Structures</td>
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<tr>
<td>CB 746-S</td>
<td>Reliability in Civil Engineering</td>
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</table>

**APPLIED RESEARCH:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
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</thead>
<tbody>
<tr>
<td>CB 799</td>
<td>Applied Research</td>
<td>6</td>
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</table>

**Subtotal**  
6 Credit Hours  
6

**Total**  
36
Course Detailed Structure

Construction and Building Engineering
(A) Construction Eng. and Management Group

**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 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

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 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 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 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 Detailed Structure

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 Eng. and Management Group

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 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  Construction and Building Engineering
(A) Construction Eng. and Management Group

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 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 Eng. and Management Group

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
Course Code : CB 718-C
Course Title : Health and Safety in Construction
Credit Hours : 3

Course Description

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

Course Topics
- Introduction to occupation health and safety in construction
- Health and safety laws and codes
- Organizing for health and safety
- Procedures for health and safety
- Health and safety management system
- Construction site issues
- Working at heights – hazards and control
- Excavation work – hazards and control
- Work equipment – hazards and control
- Electrical and fire – hazards and control

References
Course Detailed Structure  Construction and Building Engineering
(B) Envir’al, Water Res. and Coastal Eng. Group

Course Code : CB 720
Course Title : Water Quality Management and Waste Water Treatment
Credit Hours : 3

Course Description
Water quality standards, water quality management in rivers and lakes, water pollutants sources, water and waste-water treatment systems, pollution of natural water bodies, ground water pollution, effects of water pollution on health and vegetation, development and implementation of pollution prevention programs.

Course Objectives
To enable the student to acquire the steps of water and waste water treatment, identify the characteristics of different water pollutants, and evaluate the effects of water pollution on health and vegetation.

Course Topics
- Water quality standards
- Water quality management in rivers and lakes
- Water pollutants sources, water and waste-water treatment systems
- Pollution of natural water bodies
- Ground water pollution
- Development and implementation of pollution prevention programs

References
Course Code : CB 721
Course Title : Air Pollution and Indoor Air Quality
Credit Hours : 3

Course Description
Air pollution sources and identification, modeling of air pollution, monitoring and control instruments, green house effect, air-water exchange, emission standards from industrial sources, atmospheric dispersion, effects of air pollution on health and vegetation, automotive exhaust emissions, meteorology, acid rains, sources and control of indoor air pollution.

Course Objectives
To enable the student to identify the characteristics of different air pollutants, acquire the methods of air pollution control, and evaluate the effects of air pollution on health.

Course Topics
- Air pollution sources and identification
- Modeling of air pollution
- Air-water exchange
- Atmospheric dispersion
- Effects of air pollution on health and vegetation, meteorology
- Sources and control of indoor air pollution, measurement techniques

References
Course Code : CB 722
Course Title : Management of Solid, Hazardous and Radioactive Waste
Credit Hours : 3

Course Description
Sources and characteristics of solid waste and hazardous, collection and transportation systems, solid waste storage and recycling, waste minimization, resource conservation and recovery, treatment technologies, ground water contamination and remediation, management of radiological solid waste, effects of radioactive waste on health and vegetation.

Course Objectives
To enable the student to identify the characteristics of different Solid waste and hazardous, acquire the methods of solid waste storage and recycling, and evaluate the effects of radioactive waste on health and vegetation.

Course Topics
- Sources and characteristics of solid waste and hazardous
- Collection and transportation systems
- Solid waste storage and recycling
- Waste minimization, resource conservation and recovery
- Treatment technologies
- Ground water contamination and remediation
- Management of radiological solid waste

References
Course Code : CB 723
Course Title : Environmental Impact Assessment of Civil Engineering Projects
Credit Hours : 3

Course Description
Origins of Environmental Impact Assessment, EIA procedure, policy options, legislative options, methods of project screening for EIA, preparation and review of an EIA, contribution of Civil Engineer in environmental control, case study.

Course Objectives
To enable the student to learn the procedure for conducting an Environmental Impact Assessment (EIA), understand the civil engineer role in environmental control, and evaluate the environmental impact of civil engineering projects.

Course Topics
- Origins of Environmental Impact Assessment
- EIA procedure
- Policy and legislative options
- Methods of project screening for EIA
- Preparation and review of an EIA
- Contribution of Civil Engineer in environmental control
- Case studies

References
Course Code : CB 726
Course Title : Noise Pollution
Credit Hours : 3

Course Description
Physical properties of sound, effects of noise on people, noise sources and criteria, noise standards, noise measurement, outdoor propagation of sound, noise section of an Environmental Impact Assessment, traffic noise prediction, noise pollution control and prevention, noise regulation.

Course Objectives
To enable the student to learn the physical properties of sound, identify the noise sources and the means of noise reduction, and evaluate the effects of noise on human beings.

Course Topics
- Physical properties of sound
- Effects of noise on people
- Noise sources, criteria, and noise standards
- Outdoor propagation of sound
- Noise section of an Environmental Impact Assessment
- Traffic noise prediction
- Noise pollution control and prevention
- Noise regulation

References
Course Code : CB 727
Course Title : Marine Pollution
Credit Hours : 3

Course Description
Sources of marine pollution, marine ecology, oil and seashore pollution, monitoring and control instruments, modeling of marine pollution, ecological effects, prevention and regulation in marine sector, effect of marine pollution on birds and aquatic beings, marine pollution costs, case studies.

Course Objectives
To enable the student to identify the sources of marine pollutants, learn new techniques of monitoring and control instruments, and evaluate the effects of marine pollution on health and economy.

Course Topics
- Sources of marine pollution
- Monitoring and control instruments
- Modeling of marine pollution
- Prevention and regulation in marine sector
- Effect of marine pollution on birds and aquatic beings
- Marine pollution costs, case studies

References
Course Detailed Structure

Course Code :  CB 729
Course Title :  Energy and Natural Resources Conservation
Credit Hours :  3

Course Description
Methods of energy conservation in buildings, natural resources conservation, environmental architecture, selection of green materials, resource recovery, recycling, life cycle strategy, elements of waste minimization strategy, benefits of waste minimization, waste reduction techniques, case study

Course Objectives
To enable the student to acquire the methods of energy conservation and selection of green materials, understand the vitality of natural resources conservation, and learn new techniques of recycling and waste minimization.

Course Topics
- Methods of energy conservation in buildings
- Natural resources conservation, environmental architecture
- Selection of green materials
- Resource recovery, recycling, life cycle strategy
- Elements of waste minimization strategy
- Benefits of waste minimization
- Waste reduction techniques
- Case study

References
Course Detailed Structure

Course Code : CB 763
Course Title : Advanced Hydrology and Climatology
Credit Hours : 3

Course Description
The hydrologic cycle, Application of the hydrologic budget, precipitation, average precipitation, Evaporation, Transpiration, Evapotranspiration, Rainfall water losses, Stream flow, Stream flow estimation, Morphological and hydrological studies of watersheds, Introduction to ground water, Types of aquifers, Two-dimensional flow equation, Initial and boundary conditions, Groundwater flow net, Analytical solution, Simplified solution for flow equations, Pumping tests, Evaluation of ground water resources, Ground water pollution control.

Course Objectives
To enable practicing engineers to understand different elements of hydrology, Establish rainfall-runoff relationship, and understand channel routing methods. To comprehend the effects of climatic changes on the globe hydrologic cycle.

Course Topics
- The hydrologic cycle,
- Application of the hydrologic budget
- Evaporation, transpiration, and evapotranspiration
- Morphological and hydrological studies of water sheds or basins
- Stream flow and stream flow estimation,
- Introduction to ground water
- Two-dimensional flow equation
- Analytical solution and simplified solution for flow equations
- Evaluation of ground water resources and pumping tests / artificial recharge

References
Course Code: CB 764
Course Title: River Engineering
Credit Hours: 3

Course Description
River morphology, local scour and accretion, introduction to sediment transport theory, river training, river bank protection, river navigation enhancement, field data collection and analysis. Morphology of river mouth and estuary hydrodynamics. Applications of computer models to river flow and hydraulic structures.

Course Objectives
To enable the student to deal with river morphological problems, analyze local scour, align and plan river navigation, and collect river field data.

Course Topics
- River morphology
- Local scour and accretion
- Sediment transport theory and computer applications
- River training and river bank protection
- River navigation enhancement and port planning
- Field data collection and analysis

References
- Carling, P. A.; “Advances in Fluvial Dynamics and Stratigraphy”; 1996; Wiley-Liss Inc., U. S.
- Per Brunn, “Port Engineering”; 1981; Gulf Publishing Co.; Houston, USA
Course Code : CB 768
Course Title : Water Resources Planning and Management
Credit Hours : 3

Course Description
Watershed Hydrology, surface and subsurface water resources management, irrigation and drainage. Problems related to water resources utilization, optimal conjunction use of water resources, water conservation and capacity building. Ecological and economical considerations for water resources planning and management using linear and dynamic programming. Introduction to climatology and effects of climatic changes on water resources.

Course Objectives
To enable practicing engineers to be capable of managing available water resources, solve problems related to water resources utilization, and apply linear and dynamic programming for water resources management.

Course Topics
- Water quality of surface and groundwater
- Surface and subsurface water resources management and climatic effects
- Problems related to water resources utilization and water availability
- Optimal conjunction use of water resources and use of information technology
- Linear programming
- Dynamic programming
- Computer applications

References
Course Code : CB 769
Course Title : Structures for Sustainable Water Resources Management
Credit Hours : 3

Course Description
Application of hydrology, hydraulics, principles of project formulation, and system analysis, in the selection of integrated water resources systems. Water resources management systems include water supply components for urban and agricultural usage, structures for flood and storm water management and drainage or reuse of wastewater. Discussion of technical papers and computer models related to case studies on sustainable development of surface and groundwater, system selection, construction and operation, maintenance and other topics.

Course Objectives
To prepare graduate students and industry professionals with the fundamental concepts and techniques to identify integrated hydraulic structures required for a water resources management system realizing today's associated environmental, climate, economic and water demands considerations in the region including coastal zones.

Course Topics
- Management in the Water Industry: review of basic engineering and economic planning concepts.
- Water and the Environment: use of information technology for sustainable development of water resources (Hydroinformatics)
- Hydrology Frequency Analysis
- Modeling Watershed Hydrology: surface water, ground water, and water quality
- Water Management in Estuaries and Coastal Zone
- Water Resources System Analysis
- Hydraulic Structures Management Systems and Infra-Structure
- Case studies of Water Resources Management in Arid, Semi-Arid Regions and Coastal Zone

References
Course Code: CB 763-I
Course Title: Ocean and Coastal Processes for Project Engineers
Credit Hours: 3

Course Description
Introduction to the physical properties and behavior of seawater, interactions of seawater with the ocean basins, and the practices of ocean research and engineering. Introduction to the physical properties and behavior of wind and impulsively generated surface gravity waves, measurements and characterizations of ocean wave climate, and interactions of ocean waves with structures and natural coastal features. Introduction to non-linear dynamic interaction between waves and structures and the use of design computer tools.

Course Objectives
The objective of this course is to provide construction engineers with the basic principles and design parameters related to the design of marine structures in the coastal and near shore waters.

Course Topics
- Coastal and ocean environment
- Water waves; wind and impulsively generated waves
- Short term wave analysis
- Tides and water levels
- Wave transformation
- Basic shore processes
- Design of structures and fluid structure interaction
- Risk analysis and damage
- Introduction to coastal management

References
Course Code: CB 764-I
Course Title: Hydrographic Surveying and Coastal Measurements and Analysis
Credit Hours: 3

Course Description
The course provides students with knowledge of and skills to apply physical principles, instrumentation, data analysis methods, and visualization products associated with hydrographic surveying, chart publication, and related marine measurement practices of government and industry. Review of and practice with modern instrumentation, equipment, sampling and measurement techniques, and methods of analysis for quantitative study of spectral coastal ocean physical processes.

Course Objectives
To provide project engineers with the capability to collect oceanographic and engineering marine data, which include water level measurements and hydrographic surveys, analyze data, and interpret analytical results to define near shore bathymetry, waves, tides, and coastal processes.

Course Topics
- Overview of physical design parameters for water and sediments
- Equipment and measuring techniques; in place and remote: Waves, currents, water levels and sediment transport rates
- Short term analysis for design parameters
- Long term analysis for design parameters

References
- American Society of Civil Engineers; “Ocean Waves Measurement and Analysis”; 1995; N.Y.; USA.
Course Code : CB 765-I
Course Title : Management of Water Resources and Coastal Projects
Credit Hours : 3

Course Description
The course provides an overview for project execution steps from the early stages of formulation to project start up; overview of environmental design parameters related to ambient water, soil and air; design criteria and construction aspects methods and equipments for major river and estuary structures which include river training, bridge piers, flow control structures, submerged tunnel and storm surge barriers; design criteria and construction methods of some selected coastal structures are presented which embrace pile-supported structure, bulkheads & quaywalls, breakwaters and submarine pipelines. Techniques and equipment for dredging and beach nourishment.

Course Objectives
Provide the project engineer in industry with the design criteria and construction methods of major structures and operations in rivers, estuary and coastal waters. Introduce the physical environmental design parameters related to the design and construction of hydraulic and coastal structures. The course outlines design criteria, material selection and construction methods of selected structures in rivers and along the coastline. The course lays the ecological and social impacts of construction which are required to assess the sustainability of proposed water related projects.

Course Topics
- Engineering projects for river and estuary structures
- Engineering projects for coastal structures
- Design criteria and construction of lined open channels
- Design and construction of water intake and navigation structures
- Design criteria and construction of piers for over water bridges and scour mitigation methods
- Design criteria and construction of river flow diversion structures
- Design and construction of drainage structures
- Integrated coastal zone management
- Design criteria and installation of marine pile-supported and bulkhead structures
- Design criteria and types of coastal protection works (rigid and flexible)
- Construction methods of shore-connected and offshore protection structures
- Beach nourishment techniques and equipment
- Ecological and social impacts of river and coastal construction

References
Course Code : CB 766-I
Course Title : Integrated Management of Ports and Coastal Zones
Credit Hours : 3

Course Description
The marine environment and shoreline processes and their use and management, with special emphasis on the integrated management of ports and coastal zones and their mutual interaction.

Course Objectives
- To offer an outstanding opportunity to gain detailed knowledge of concept of the Integrated Coastal Zone Management.
- To ensure a solid foundation in these keys aspect of Integrated Coastal Zone Management.

Course Topics
- An introduction to coastal zones.
- Dynamics of Geophysical Fluids
- Littoral Processes and Coastal Evolution
- Planning and Management
- Integrated Management of Coastal Zones and Port Areas; definitions, objectives, urgencies and benefits.
- Approach of ICZM; integration and arrangements
- Practice of ICZM; stages, initiation, planning, implementation, monitoring and evaluation
- Methods, tools and techniques of ICZM
  - Classes of useful methods, tools and techniques
  - Environmental Impact assessment (EIA) techniques
  - Policy tools
- General overview of ICZM
- Case study

References
Course Detailed Structure  
Construction and Building Engineering  
(B) Envir’al, Water Res. and Coastal Eng. Group

Course Code : CB 767-I  
Course Title : Port Planning and Development  
Credit Hours : 3

Course Description
The course provides an overview for the keys aspects of port planning and development in the context of water theory, port planning and its items, on shore marine terminal facilities, dredging and reclamation and guidelines for ports developments. All major aspects of the design and maintenance of port facilities, including port planning, design loads for today's larger vessel size, seismic design guidelines, and breakwater design.

Course Objectives
Provide the project engineer in industry with the following:

- A solid foundation in the keys aspect of port development and planning and the design of port structures.
- An outstanding opportunity to gain detailed knowledge of the contractual framework and practical application of port development and planning and practical application of the design of port structures.

Course Topics
- Wave theory, Wave diffraction inside Ports
- Port Planning; definition and strategic planning
- Items of port planning; breakwaters, navigation channel, port entrance, turning basin, Dock structures (Quays, Jetties and Dolphins), berths and on-shore facilities.
- On shore marine terminals facilities
- Dredging and reclamation
- Guidelines for ports developments
- Ports mitigation measures and monitoring plans
- Beach nourishment
- Breakwaters: definition and types (vertical, rubble mound, composite breakwater, reef breakwater, detached breakwater and floating breakwater).
- Breakwater failures types.
- Breakwater design methods.
- Dock structures (Quays, Jetties and Dolphins)
- Design of gravity quay wall.
- Design of sheet pile wall.
- Fender systems; wood fenders, rubber fenders and foam filled fenders
- Dredging and reclamation; definition and Equipments.
- Case study

References
• Goda, Y., 2000. *Random Seas and Design of Maritime Structures*, University of Tokyo Press, Tokyo
• Gerwick, Ben C. Jr.; “Construction of Marine and Offshore Structures”; CRC Publisher Press; New York; USA; 2nd edition; 2002
Course Code: CB 731
Course Title: Advanced Geotechnical Engineering
Credit Hours: 3

Course Description
Planning of soil exploration program; Site improvement and soil stabilization techniques; Methods of dewatering; Geotechnical problems associated with dewatering; Design of filters; Planning for site preparation: Site investigation for piling; Contiguous-piles and Secant-piles; Retaining walls; Problems in pile construction; Integrity testing; Pile testing; Types of problematic soils; Collapsible soils: Types, Field tests for collapsible soils, Laboratory experiments, Foundations on collapsible soils.

Course Objectives
To develop an understanding of a variety of state-of-art advanced techniques in geotechnical engineering utilized in construction projects.

Course Topics
- Planning an exploration program.
- Field tests: SPT, CPT, Plate load test.
- Compaction, precompression, vibroflotation, vibro-replacement.
- Sand drains; Prefabricated Vertical Drains (PVDs) or wick drains.
- Sand compaction piles, stone columns, and dynamic compaction.
- Purpose of grouting: advantages and disadvantages, planning the grouting projects.
- Methods of dewatering; Geotechnical problems associated with dewatering.
- Selection of the dewatering method; Design of filters.
- Planning for site preparation.
- Contiguous-piles and Secant-piles; Retaining walls.
- Problems in pile construction: Integrity testing; Pile testing; Pile dynamics.
- Types of problematic soils.
- Collapsible soils; Types, Field tests for collapsible soils. Laboratory experiments.
- Foundations on collapsible soils.

References
Course Detailed Structure  Construction and Building Engineering

(C) Geotech. and Transp. Eng. Group

Course Code : CB 733
Course Title : Earth Works and Dewatering
Credit Hours : 3

Course Description
Specifications of earth works and dewatering; Methods of excavations; Methods of embankment construction; Methods for slope stabilization; Analysis of slope stability; Use of geomembranes for slope stability; Specifications of the filling materials; Seepage problems; Methods of dewatering; Geotechnical problems associated with dewatering; Design of filters; Planning for site preparation.

Course Objectives
To illustrate to the student procedures and special precautions in the earth works with emphasis on soil stability considerations and dewatering techniques and safety measures.

Course Topics
- Specifications of earth works and dewatering;
- Different methods of excavations;
- Methods of embankment construction;
- Methods for slope stabilization;
- Analysis of slope stability
- Use of geomembranes for slope stability
- Specifications of the filling materials
- Two- and three-dimensional seepage problems
- Methods of dewatering
- Geotechnical problems associated with dewatering
- Selection of the dewatering method
- Design of filters
- Planning for site preparation

References
Course Code : CB 736
Course Title : Foundation on Problematic Soils
Credit Hours : 3

Course Description
Types of problematic soils; Swelling soil; Types of swelling soils, Basic definitions and characteristics, Classification, Laboratory experiments, methods for foundations on swelling soils; Collapsible soils; Types, Field tests for collapsible soils, Laboratory experiments, Foundations on collapsible soils; Soft clay soils; Basic definitions; Field tests for soft clays; Laboratory experiments; Foundations on soft clays.

Course Objectives
To introduce the student to the types of problematic soils and the special considerations taken when constructing projects on each type.

Course Topics
- Types of problematic soils;
- Swelling soil; Types of swelling soils,
- Basic definitions and characteristics, Classification,
- Laboratory experiments, methods for foundations on swelling soils;
- Collapsible soils; Types, Field tests for collapsible soils,
- Laboratory experiments,
- Foundations on collapsible soils;
- Soft clay soils; Basic definitions; Field tests for soft clays; Laboratory experiments;
- Foundations on soft clays.

References
Course Detailed Structure

Course Code : CB 737
Course Title : Piling Engineering
Credit Hours : 3

Course Description
Site investigation for piling; Basic piling methods; Design of single piles; Design of pile groups; Design of piles subjected to lateral loads; Special considerations for design and construction of offshore piles; Tension leg platforms; Load distribution among group piles; Retaining walls; Problems in pile construction; Integrity testing; Pile testing; Pile dynamics; Choice of pile construction method and economics of design.

Course Objectives
To illustrate to the student the types of piled foundations and the advantages and limitations in construction and performance for each type.

Course Topics
- Site investigation for piling; Basic piling methods
- Capacity of single piles; Capacity of pile groups
- Piles subjected to lateral loads
- Contiguous-piles and Secant-piles Retaining walls
- Problems in pile construction
- Integrity testing; Pile testing; Pile dynamics
- Choice of pile construction method and economics of design

References
- Fleming, Weltman, Randolph and Elson, "Piling Engineering", Blackie, 1992
Course Code : CB 738
Course Title : Special Geotechnical Structures
Credit Hours : 3

Course Description
Cofferdams: Types; Single raw sheet pile cofferdam; method of analysis; construction sequence; Geotechnical construction considerations; Double raw sheet pile cofferdam; Construction sequence; Geotechnical construction considerations; Cellular cofferdams; Required data for cellular structure design and installation; design procedure; Field procedures and problems; Caissons: Types of caissons; Sinking and control; Carrying capacity of caisson as a foundation element.

Course Objectives
To introduce to the student types of special geotechnical structures implemented in large complex projects with emphasis on special considerations in the design and construction method of each type.

Course Topics
- Cofferdams: Types; Single raw sheet pile cofferdam;
- Method of analysis; construction sequence;
- Geotechnical construction considerations;
- Double raw sheet pile cofferdam; Method of analysis;
- Construction sequence; Geotechnical construction considerations;
- Cellular cofferdams; Required data for cellular structure design and installation; design procedure;
- Field procedures and problems;
- Caissons: Types of caissons; Caisson design considerations; Sinking and control; Carrying capacity of caisson as a foundation element.
- Diaphragm walls.

References
Course Code : CB 733-G
Course Title : Elastic Analysis of Soil–Foundation Interaction
Credit Hours : 3

Course Description
Introduction to soil-foundation interaction problems; Idealized soil response models for analysis of soil–foundation interaction; Plane-strain analysis of an infinite plate and an infinitely long beam; Analysis of beams of finite length; Axisymmetric three–dimensional problem of an infinite plate; Analysis of finite plates; Determination of soil parameters; Experimental investigation and field studies.

Course Objectives
To introduce to the student the analysis methods of elastic interaction between soil and foundations.

Course Topics
- Introduction to soil-foundation interaction problems;
- Idealized soil response models for analysis of soil–foundation interaction
- Plane-strain analysis of an infinite plate and an infinitely long beam
- Analysis of beams of finite length;
- Axisymmetric three–dimensional problem of an infinite plate;
- Analysis of finite plates;
- Determination of soil parameters;
- Experimental investigation and field studies.

References
Course Code : CB 751
Course Title : Fundamental of Traffic Flow Theories
Credit Hours : 3

Course Description
The course covers topics in the area of traffic flow characteristics, volume, flow, PHF, variation of traffic volume, AADT, ADT, DHV, speed-density model, flow-density model and speed-flow model. It also covers topics in the area of fundamental principles of traffic flow, level of service, basic freeway capacity, multilane highway capacity, two lane highway capacity, flow interruptions, intersection control and design, traffic signals, intersection capacity.

Course Objectives
To provide better understanding in the area of fundamental elements of traffic flow theories and traffic analysis tools for important highway segments as in two-lanes, multi-lanes and intersections.

Course Topics
- Traffic flow characteristics, volume, flow, PHF and variation of traffic volume
- AADT, ADT, DHV, speed-density model, flow-density model and speed-flow model
- Fundamental principles of traffic flow, level of services
- Basic freeway capacity
- Multilane highway capacity and two lane highway capacity
- Flow interruptions
- Intersection control and design
- Traffic signals
- Intersection capacity

References
Course Code : CB 752
Course Title : Structural Design for Highway and Airport Pavements
Credit Hours : 3

Course Description
The course covers topics in the area of pavement types, flexible and rigid pavement, principles for flexible pavements, calculation of flexible pavement stresses and deflections, the AASHTO flexible pavement design procedure, serviceability concept, structural number, principles for rigid pavements, calculation of rigid pavement stresses and deflection, the AASHTO rigid pavement design procedure, pavement rehabilitation management, the FAA method of design for flexible and rigid airport pavements, CBR method of design for flexible airport pavements, pavement design using elastic layer theory.

Course Objectives
To provide a complete analysis in the area of stress distribution in pavement due to different traffic loads, cover the major design methods for flexible pavements, and cover the major design methods for rigid pavements.

Course Topics
- Pavement types, flexible and rigid pavement
- Flexible pavement stresses and deflections
- The AASHTO flexible pavement design procedure
- Serviceability concept, structural number
- Principles for rigid pavements
- The AASHTO rigid pavement design procedure
- Pavement rehabilitation management
- The FAA method of design for flexible and rigid airport pavements
- CBR method of design for flexible airport pavements, pavement design using elastic layer theory

References
Course Code : CB 753
Course Title : Transportation Planning and Management
Credit Hours : 3

Course Description
The course covers topics in the area of transportation planning (transportation problems, trends in transportation planning), urban transportation planning (elements of planning, planning process, goods movement planning), forecast of urban transport demand (data collection and analysis, goals and objectives, aggregate sequential demand models), sketch planning and project planning (generation, analysis and evaluation of alternative plans, risk and uncertainty).

Course Objectives
To provide basis of transportation planning and to grasp the sequential demand forecasting modeling.

Course Topics
- Transportation planning
- Urban transportation
- Forecast of urban transport demand
- Sketch planning and project planning

References
### Course Detailed Structure

**Course Code**: CB 756  
**Course Title**: Special Topics in Transportation and Highway Engineering  
**Credit Hours**: 3

#### Course Description

The course covers topics in the area of transportation and the environment, transpiration safety, intelligent transportation systems, geographic information system application GIS, global positioning systems applications GPS, computer applications for transportation, computer simulators for transportation, energy efficiency and use, mass transit transportation, noise pollution fundamentals.

#### Course Objectives

To present different applications of computer technology in the field of transportation, such as GIS and GPS, Computer Modeling and Simulation.

#### Course Topics

- Transportation and the environment
- Transpiration safety
- Intelligent transportation systems
- Geographic information system application GIS
- Global positioning systems applications GPS
- Computer applications and simulators for transportation
- Energy efficiency and use, mass transit transportation
- Noise pollution fundamentals

#### References

- The U.S. Department of Transportation Internet Web Site (www.dot.gov).
Course Code : CB 758
Course Title : Highway Construction and Management
Credit Hours : 3

Course Description
The course covers topics in the area of aggregates (source - classification - properties - evaluation tests - combining of aggregates), bituminous materials (native asphalts - manufacture of asphalts - asphalt cement - liquid asphalt - emulsions), asphalt tests (liquid asphalt test, emulsion tests), highway machinery (earth moving, compaction, aggregates crushing), asphalt machinery (plants, spreaders,...).

Course Objectives
To review material properties, testing in association with highway construction, different methods of construction and involved equipments.

Course Topics
- Aggregates (source - classification - properties - evaluation tests - combining of aggregates)
- Bituminous materials
- Asphalt tests (liquid asphalt test, emulsion tests)
- Highway machinery (earth moving, compaction, aggregates crushing)
- Asphalt machinery (plants, spreaders, etc...)

References
- Standard Specifications for Transportation Materials and Method of Sampling and Testing, AASHTO, Washington DC.
Course Code : CB 759
Course Title : Traffic Engineering and Environment
Credit Hours : 3

Course Description
This course covers topics in the area of basic principles of sound waves in free fields and enclosures, effect of noise on people, adding and subtracting sound levels, traffic noise descriptors, traffic noise prediction techniques, prediction procedure, mathematical algorithm, correction for road gradient, source height, source position, mitigation measures, sound barriers, pavement types, principles of sound barrier design, reduction in sound barrier performance due to holes, silts or gaps, examples of sound barrier analysis.

Course Objectives
To review basis of traffic noise, to provide traffic noise prediction techniques, and to provide noise barrier design methods.

Course Topics
- Basic principles of sound waves in free fields and enclosures
- Effect of noise on people, adding and subtracting sound levels
- Traffic noise descriptors, traffic noise prediction techniques
- Mathematical algorithm
- Correction for road gradient, source height, source position, mitigation measures
- Sound barriers, pavement types, principles of sound barrier design
- Silts or gaps
- Examples of sound barrier analysis

References
Course Code : CB 752-T
Course Title : Advanced Construction Surveying
Credit Hours : 3

Course Description
The different types of projects traverses, the purpose and types of cadastral surveying traverses in cities and countries, the field traverse and its procedure, the public work traverse and methods of fixing boundary marks, the city traverse and its requirements, the three points problem and the mechanical, legman and three circles methods, cadastral and town mapping. Adjustment of structure verticality, study of crustal movement and geodetic techniques for detecting horizontal and vertical structural deformations. Laser instruments and techniques in various surveying applications such as leveling, land reclamation, etc. Precise methods for measuring horizontal angles.

Course Objectives
To provide the graduate with most advanced equipments in the field of construction surveying. In addition to, different methods of analysis and correction of coordinate systems.

Course Topics
- Projects traverses
- The three points problem and the mechanical
- Legman and three circles methods
- Cadastral and town mapping
- Adjustment of structure verticality
- Study of crustal movement and geodetic techniques for detecting horizontal and vertical structural deformations
- Laser instruments and techniques in various surveying applications such as leveling, land reclamation, etc.
- Precise methods for measuring horizontal angles

References
Course Code: CB 753-T
Course Title: Geographic Information Systems for Construction Engineering
Credit Hours: 3

Course Description:

Course Objectives:
To introduce and illustrate how the Geographic Information System (GIS) can be built up to analyze and understand various problems in construction engineering.

Course Topics:
- Basics and components of GIS
- Types of data entry and tools
- Sequence of building GIS system
- Analytical functions and how to use them
- General applications for construction engineering
- GIS for transportation engineering
- GIS for highway engineering
- GIS for geotechnical engineering
- GIS for environmental engineering

References:
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 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 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 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.
- Manual of Concrete Practice, 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 Detailed Structure

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 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 Detailed Structure

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.

CourseTopics
- 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 Detailed Structure

Course Code : CB 743-S
Course Title : Structural Dynamics and 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 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