College of Environmental Design

Master of Construction Engineering and Management (ME) Program

Overview

The graduate program in the Department of Construction Engineering & Management (CEM) at King Fahd University of Petroleum & Minerals (KFUPM) has been in existence since 1984. The program offers two options, one leading to a Master of Science (M.S.) and the other leading to Master of Engineering degrees (ME). Both programs are available on a fulltime and a part-time basis. The student population in the program has averaged around forty students, the majority of whom are practicing engineers working for various public and private organizations.

In order to keep pace with the global trend emanating from the dynamic nature of construction and increasing technological advancement, the program underwent a revision in 2016. The objectives of changes (updates) are (a) to update the programs to reflect the current state of knowledge in the CEM specialty, (b) to make the programs responsive to the future needs of the Kingdom of Saudi Arabia, and (c) to face the challenges of globalization in the construction industry.

The program emphasizes academic and research excellence along with professional development of student in particular area of interest. The program offers wide selection of courses and research activities related to construction engineering which satisfies the local as well as the global needs of the industry.

Program Objectives

Within few years after graduation, our graduates will be able to:

1. Graduates will advance in their professional careers and attain leadership roles in their respective organizations.
2. Graduates will pursue advanced degrees or seek professional certification in Construction Engineering and Management or related field.
3. Graduates will actively participate in professional and scientific activities relevant to Construction Engineering and Management.

Admission Requirements

Admission to either program requires fulfilling all KFUPM's and Deanship of Graduate Studies' requirements. In addition, the applicant should meet the following CEM requirements:

- Bachelor's degree in Engineering (preferably Civil, or Architectural Engineering) or equivalent to the KFUPM Bachelor's degree.

- Applicants from other institutions or other related fields (such as Mechanical or Electrical Engineering) may have to take extra courses to cover areas of deficiency without graduate credit.
- The Master of Engineering program is unavailable for Research or Graduate Assistants because of the research emphasis and requirements of such students.

Program Requirements

The M.E. option requires the completion of 33 credit hours, which include 18 credit hours of core courses, 9 credit hours of CEM electives, 3 credits of graduate electives courses either from within or outside the CEM Department, a research seminar and 3 credit hours of Master of Engineering Report. Table 1 describes the plan of study.

Table 1. MASTER OF ENGINEERING ACADEMIC PROGRAM REQUIREMENTS

Master of Engineering (Non thesis-33 Credits)	**Credits**
CEM 510 Project Planning and Scheduling	**3**
CEM 511 Construction Estimating	**3**
CEM 520 Construction Contracting & Administration	**3**
CEM 530 Construction Engineering	**3**
CEM 540 Construction Project Management	**3**
CRP 505 Statistical Analysis in Planning	**3**
CEM 599 Research Seminar in CEM	**0**
CEM 5XX CEM Elective	**3**
CEM 5XX CEM Elective	**3**
CEM 5XX CEM Elective	**3**
XXX 5XX Free Elective	**3**
CEM 600 Master of Engineering Report	**3**
	33

[1]Students could take OM 502 Statistical Analysis for Business in lieu of CRP 505.

[2] This elective course is to be selected from graduate courses from inside or outside the CEM Department.

- Each student is expected to submit his detailed degree plan according to the above generic degree plan for approval by the Department and the Deanship of Graduate Studies by the middle of the second semester from enrolment.
- Students are required to adhere with the regulations of degree plan. No relaxations will be given to any student and the courses taken in conflict of the above will not be counted towards the degree.
- The order of taking the courses can be different from above but students must take the core courses before electives.

Elective Courses

Three (3) credit hours of free electives from graduate courses with the approval of the department.

Business school Courses:

Course No.	Course Name	Prerequisite
ACCT 510	Managerial Accounting	ACCT 501
ACCT 512	Cost Management System	ACCT 510
ACCT 515	Computerized Accounting Information System	ACCT 510
ECON 501	Principles of Economics	Graduate Standing
FIN 501	Corporate Finance	ACCT 501
MIS 502	Management Information Systems	Approval of MBA Dept
MGT 511	Organizational Theory and Design	MGT 501
MGT 521	International Business	MGT 511, ECON 510
MKT 501	Principles of Marketing	Graduate Standing
MKT 512	Applied Marketing Research	OM 502, MKT 501
MKT 513	Strategic Marketing	MKT 501
OM 511	Management Science	OM 502
OM 512	Production & Operations Management	OM 511

Architectural Engineering Department courses:

Course No.	Course Name	Prerequisite
ARE 510	Computing Utilization in Architectural Engineering	Graduate Standing
ARE 511	Construction And Maintenance Modeling	Graduate Standing
ARE 512	Building Life Cycle Costing	Graduate Standing

Course No.	Course Name	Prerequisite
ARE 513	Building System Evaluation & Selection	ARE 500 or equivalent
ARE 514	Post-Occupancy Evaluation	Graduate Standing
ARE 515	Facilities Operation & Maintenance	Graduate Standing
ARE 516	Safety System in Buildings	Graduate Standing
ARE 517	Building Defects and Maintenance	Graduate Standing
ARE 520	Principles of Facilities Management	Graduate Standing
ARE 522	Facilities Planning & Relocation	ARE 520
ARE 524	Facilities Maintenance Management	Graduate Standing
ARE 526	Computer Aided Facilities Management	ARE 520
ARE 528	Real Estate Management	Graduate Standing
ARE 529	Quality Assessment of facilities Management	ARE 520

Civil Engineering courses:

Course No.	Course Name	Prerequisite
CE 502	Evaluation and testing of Concrete Structures	Consent of Instructor
CE 503	Building Defects and Maintenance	ARE 525
CE 521	Advanced Reinforced Concrete Design	Graduate Standing
CE 522	Pre-stressed Concrete	Graduate Standing
CE 535	Design of Dams and Hydraulic Structures	CE 330
CE 550	Nature and Behavior of Soils	Graduate Standing
CE 551	Advanced Soil Mechanics	Graduate Standing
CE 556	Earth Structures	Graduate Standing

Course No.	Course Name	Prerequisite
CE 571	Transportation Planning & Modeling	STAT 315
CE 572	Methods of Analysis for Planners	STAT 315
CE 573	Transportation System Analysis	STAT 315
CE 574	Structural Design of Pavements	Graduate Standing
CE 575	Performance and Rehabilitation of Pavements	CE 574
CE 576	Highway Geometric Design	Consent of Instructor
CE 577	Airport Design	Graduate Standing
CE 579	Pavements Materials	Consent of Instructor

City & Regional Planning courses :

Course No.	Course Name	Prerequisite
CRP 504	Advanced Urban Economics	Graduate Standing
CRP 507	Computer Aided Design	Graduate Standing
CRP 512	Advanced Quantitative Methods	Graduate Standing
CRP 514	Geographic Information System	Graduate Standing
CRP 533	Public Works Administration and Management	Graduate Standing

Information and computer science courses:

Course No.	Course Name	Prerequisite
ICS 582	Natural Language Processing	ICS 381
ICS 585	Knowledge-Based System	Programming knowledge

Systems engineering courses:

Course No.	Course Name	Prerequisite
SE 501	Survey of Operations Research & Its Applications	Graduate Standing
SE 505	Real-Time Computer Systems	Graduate Standing
SE 508	Advanced Production System	SE 402
SE 511	Computer Aided Design	Graduate Standing
SE 523	Forecasting Systems	Graduate Standing
SE 531	System Reliability/ Maintainability	Graduate Standing
SE 536	Human Factors Engineering	Graduate Standing
SE 539	System Safety Engineering	Consent of Instructor
SE 548	Sequencing and Scheduling	Consent of Instructor
SE 567	Work Physiology	Graduate Standing
SE 569	Human Factors in Computing Systems	Graduate Standing

CEM 510 Project Planning & Scheduling (3-0-3)

Planning, scheduling, and control of construction projects using Critical Path Method (CPM) and Project Evaluation and Review Technique (PERT); Resource leveling; Scheduling with limited resources; Time-cost tradeoffs, Introduction to complex networks, Short interval production sheduling, and related Computer applications.

Prerequisite: Graduating Standing

CEM 511 Construction Estimating (3-0-3)

Introduction to cost estimating of construction, types of cost estimating for construction projects, the estimating process, measuring quantity of construction works pricing construction works, pricing subcontractor works and general expenses, computer application for cost estimating, budget and elemental estimating, value analysis and lifestyle costing, recent development in construction cost estimating.

Prerequisite: Graduate Standing

CEM 512 Value Engineering (3-0-3)

Value engineering concepts, function analysis system techniques (FAST), diagramming, creativity, matrix evaluation, design-to-cost, life cycle costing, Preliminary estimating methods, human relations and strategies for organizing, performing and implementing value engineering; Sustainability; Contructability; Computer Applications.

Prerequisite: Graduate Standing

CEM 513 Construction Productivity (3-0-3)

Components of the construction productivity system; measurements of productivity: Work sampling, Craftsman's Questionnaire, Foreman Delay Survey, and related techniques. Construction methods improvement: Crew Balance, Chart, Flow Diagram and Process Chart, Quality Circles; safety workers' motivation and productivity improvement programs. Application of above techniques on real construction projects.

Prerequisite: Graduate Standing

CEM 514 Modeling Construction Operations (3-0-3)

Model Development for construction operations at project site and the contractor organization level. The application of analytical techniques in construction management. Topics include linear programming , transportation model, assignment model, queing theory, Inventory management , Monte Carlo Simulation and other applicable optimization Techniques.

Prerequisite : Gradute Standing**.** Students can't get credit for this course and EM 520 or ARE 511

CEM 515 Project Quality Management (3-0-3)

The objective of this course is to expose students to Quality knowledge and Quality improvement methods. Includes discussion on Quality standards, Quality needs and overall strategic plans, customer satisfaction and focus, tools for Quality Project Management, Statistical process control, tools for continous improvement, recent developments in Quality in Constructed projects, ISO standards, survey of computer application software related to quality management.

Prerequisite: Graduate Standing

CEM 516 Project Risk Management (3-0-3)

Putting risk into perspective, risk and uncertainty, risk management system, decision theory, game theory, utility and risk attitude, multicriteria decision making models, simulation, risks and the construction project – money, time and technical risks, contracts and risks, Vulnerability, Computer applications.

Prerequisite: CRP 505 or Equivalent, CEM 510, CEM 520 . Students can't get credit for this course and EM 530

CEM 517 Project Safety Management (3-0-3)

The objective of this course is to explain how to manage safety in Construction Projects and show why safety management is a key part of an effective Construction Mangement. The course gives specific recommendations to overall improvement of construction safety and outlines steps to reduce accidents in construction site. Students are also exposed to the available safety softwares and other computer applications.

Prerequisite: Graduate Standing

CEM 518 Project Cost Management (3-0-3)

The course includes the application of scientific principles and techniques to the problems of cost planning and cost control. The course covers a variety of issues in cost management including evaluating investment alternatives, life cycle costing, cost analysis methods, cost control, and computer applications.

Prerequisite: CEM 511. Students can't get credit for this course and EM 510 or ARE 512

CEM 519 Sustainable Constructions

Techniques and methods of sustainable construction. Integration of collaborative team effort from owners, architects, engineers, constructors, and consultants. Influences on the cost and schedule due to a sustainable construction project. LEED assessment process, high performance building and green building materials, economical analysis of green building.

Prerequisite: Graduate Standing

CEM 520 Construction Contracting and Administration (3-0-3)

Basic characteristics of the construction industry; interrelationship of the design and construction processes, construction contract documents, bidding and awarding procedures, construction claims and disputes, national labor and procurement regulations, leadership.

Prerequisite: Graduate Standing

CEM 522 Globalization and Construction Industry (3-0-3)

The course will expose the students to the differences in Construction systems, technology, management and culture among the advanced industrial countries, newly industrialized countries and local construction industry. Globalization movement and its effect on construction industry and local design and construction firms. Special aspects of International projects including investigation, planning, procurement, logistics, personnel and financing.

Prerequisite: Graduate Standing

CEM 525 Project Delivery Systems (3-0-3)

The historical evolution of project delivery, the roles of procurement and contracting methods in project success, strengths and weaknesses of contemporary delivery system. Emphasis will be placed on new trends in the Project Delivery Systems such as Construction Management (CM), Design-Build (DB), Build Operate and Transfer (BOT), Build Own, Operate and Transfer (BOOT), etc.: when to use, process variations, procurement, contracts and contracts language, performance specification, roles of parties, organization and management, conceptual estimating; , Lean construction; Computer applications.

Prerequisite: CEM 520

CEM 527 Construction Claims and Dispute Resolution (3-0-3)

Construction claims, Causes and types of construction claims, construction disputes, causes and types of construction disputes, disputes avoidance techniques, problems of traditional dispute resolution techniques, alternative dispute resolution techniques – Arbitration, mediation, conciliation, dispute review boards, mini trials, Ethics in the Construction Industry, Computer applications.

Prerequisite Graduate Standing

CEM 529 Construction Firm Management (3-0-3)

Management of Construction Company including organization, corporate structure, operation procedures, marketing, and human resources management. Emphasis on safety and loss prevention management, insurance and risk management, financing, accounting, marketing construction services, and bonding requirements for construction company. Other topics include individual and corporate planning and process of strategic planning.
Prerequisite: Graduate Standing

CEM 530 Construction Engineering (3-0-3)

Introdution to Construction Industry; construction projects; and the study of construction; types of construction works; Earthworks, Drilling, Lifting and Piling; Construction Euipment; Types of Equipment, Production Estimates, Selection of Equipment, Equipment Economic; Concrete Work and Forming System; Planning for Construction.

Prerequisite: Graduate Standing

CEM 531: Heavy Industrial Construction (3-0-3)

Project Life Cycle for building Heavy Industrial Facilities, power plants, chemical plants, oil refineries. Best practices for each stage in the project life cycle as per the Construction Industry Institute. Topics include: Job planning and organization including Pre Project Planning, Planning for Startup, Prefabrication Preassembly Modularization and Offsite Fabrication, knowledge management, Risk Management for Industrial Projects.

Prerequisite: Graduate Standing

CEM 532 Design & Cons. of Temporary Support Structures (3-0-3)

Planning and field engineering for temporary support structures. Design and Construction of concrete formwork, cofferdams, scaffolding, dewatering systems, and other temporary structures required by construction operations, Computer applications.

Prerequisite: Graduate Standing

CEM 533 Intro to Construction of Harbor, Coastal & Ocean Structures (3-0-3)

Construction methods and equipment for construction of cofferdams, caissons, wharves, marine terminal, outfall sewers, power plants intakes and discharge, sub marine oil and gas pipelines, dredging, offshore platform, ocean structures, sub-sea and deep ocean facilities, case studies.

Prerequisite: CEM 530

CEM 540 Construction Project Management (3-0-3)

An integrative perspective to Construction Project Management to tie together knowledge areas of Project Mangement that have been individually covered under various courses such as Planning and Scheduling, Cost Estimating, Quality Management, Human Resourses Management and Risk Management. Other areas to be covered include Project procurement management, Project communication management, and Computer applications.

Prerequisites: CEM 510, CEM 511, CEM 520. Students can't get credit for

this course and EM 550

CEM 542 Technology and Innovationin Constructions and Project Management (3-0-3)

Technology concepts; terminology and classifications. Construction advanced tecnologies and construction applications. Technology management in construction: R&D; technological innovation; technology deployment; support techniques, Construction technology in Saudi Arabia; innovative behavior; strategy; policy; support system; university/industry interaction, sustainability, lean construction, Research projects for industry applications.

Prerequisite: Graduate Standing

CEM 547- Construction Management with Building Information Modeling (3-0-3)

Fundamentals and practical use of information technologies in the construction industry; basic concepts of building information modeling (BIM); review of software and technology available for BIM; practical use of BIM including design and clash detection; impact of BIM on construction management functions; construction scheduling and sequencing using BIM; cost estimating using BIM; facility management with BIM; integrated approach to navigate BIM as a multi-disciplinary design, analysis, construction, and facility management technology; class exercise to create a BIM model and to use it in scheduling, sequencing, cost estimating, management, and simulation of a construction project.

Prerequisite: *CEM 510, CEM 511*

CEM 549: Computer Applications in Construction Eng. and Mgt. (3-0-3)

Use of the state of the practice applications for management of construction projects. Industry standard applications for planning and scheduling, cost estimation, 3D/4D planning, process improvement, Decision and Risk Analysis. Students work on a number of intensive construction problems.

Prerequisite: CEM 510, CEM 511

CEM 590 Special Topics in Construction Engineering & Management (3-0-3)

Advanced topics selected from the major areas of Construction Engineering and Management to provide the student with recent developments.

Prerequisite: Graduate Standing

CEM 599 Research Seminar (1-0-0)

Introduction to the principles of scientific research: The research question, hypotheses, constructs and their operationalization, research design, internal and external validities of research findings, measurements and their reliability, data collection techniques, professional ethics, basic elements of the research proposal. Grades are pass or fail.

Prerequisite: Graduate Standing

CEM 600 Master of Engineering Report (0-0-3)

A report on an independent study performed under the supervision of a CEM faculty advisor. This report should include an introduction to the topic, literature review, research methodology, analysis of data, conclusions and recommendations, appendixes and references. The report will be presented and orally examined by a faculty committee.

Prequisite : CEM 599

MASTER OF Engineering (ME) DEGREE PLAN

Course # Title		LT	LB	CR
FIRST SEMESTER				
CEM 510	Project Planning and Scheduling	3	0	3
CEM 520	Const. Contracting and Administration	3	0	3
		6	0	6
SECOND SEMESTER				
CEM 511	Construction Estimating	3	0	3
CRP 505	Statistical Analysis in Planning[3]	3	0	3
		6	**0**	**6**
THIRD SEMESTER				
CEM 530	Construction Engineering	3	0	3
CEM 5XX	CEM Elective	3	0	3
		6	**0**	**6**
FOURTH SEMESTER				
CEM 5XX	CEM Elective	3	0	3
CEM 5XX	CEM Elective	3	0	3
		6	**0**	**6**
FIFTH SEMESTER				
CEM 540	Construction Project Management	3	0	3
CEM 599	Research Seminar	1	0	0
XXX 5XX	XXX Elective[4]	3	0	3
		7	**0**	**6**
SIXTH SEMESTER				
CEM 600	Master of Engineering Report	0	0	3
		0	**0**	**6**

Total Credit Hours	**34**	**0**	**33**

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[4] This elective course is to be selected from graduate courses from inside or outside the CEM Department.

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ADDITIONAL INFORMATION

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