

New Graduate

Course and Curriculum Proposal from Department of Engineering Technology

Establishment of a Master of Science in Construction and Facilities Management**A. PROPOSAL SUMMARY AND CATALOG COPY****1. SUMMARY**

The Department of Engineering Technology proposes the creation of a Master of Science in Construction and Facilities Management (MSCFM) degree program. The MSCFM degree program will build off the body of knowledge required by the American Council for Construction Education (ACCE) for the existing construction management undergraduate degree program and will incorporate areas of knowledge required by the International Facility Management Association (IFMA). The proposed model curriculum is a 30 semester-hour program and consists of an 18-credit hour common core, a 6 credit hour elective core in either construction management or facility management, and a capstone experience including either a sequence of 6 credit hours of major electives or a formal 6 credit hour graduate research thesis. The program will be offered through both on-campus and online delivery. Initial delivery will occur on-campus with distance delivery anticipated to follow in year two.

The following 20 new graduate level courses will be created and developed:

CMET 5130 - Building Information Modeling	3 credits
CMET 5135 - Advanced Construction Planning & Management	3 credits
CMET 5240 - Safety & Risk Management	3 credits
CMET 6000 - Special Topics in Construction Management	3 credits
CMET 6180 - Alternative Project Delivery Methods	3 credits
CMET 6285 - Quality Assurance in Construction	3 credits
CMET 6290 - Temporary Structures in Construction	3 credits
CMET 6295 - Design & Improvement of Construction Operations	3 credits
CMET 6800 - Independent Study in Construction Management	3 credits
CMET 6900 - Master's Thesis & Research	1 – 6 credits
FMET 5160 - Research and Analytical Methods	3 credits
FMET 5165 - Building Energy Management	3 credits
FMET 5270 - Operation of Constructed Facilities	3 credits
FMET 6000 - Special Topics in Facilities Management	3 credits
FMET 6145 - Facilities Management Financial Analysis	3 credits
FMET 6155 - Plant Instrumentation and Controls	3 credits
FMET 6250 - Asset Management for Facility Managers	3 credits
FMET 6255 - Advanced Plant Layout and Design	3 credits
FMET 6800 - Independent Study in Facilities Management	3 credits

It is noted that twelve courses are offered as requirements of the program. Other courses included in this proposal are offered less frequently on demand.

2. PROPOSED CATALOG COPY

CMET 5130. Building Information Modeling. (3) Prerequisite: ETCE 1104 or ETGR 1104 or consent of instructor. A study of the creation, management, and application of building information models to the construction, operation, and maintenance of a facility. Focus will be on 2D and 3D computer models of building components, renderings, animations, and interfacing with analysis tools. *(Fall)*

CMET 5135. Advanced Construction Planning & Management. (3) Prerequisite: ETCE 4126 or consent of instructor. Advanced methods for planning and controlling construction projects. Topics will include resource allocation, leveling and management, critical path method (CPM) and project evaluation and review techniques (PERT) of scheduling, project controls through cost-schedule integration, and schedule compression. *(Fall)*

CMET 5240. Safety & Risk Management. (3) Causes and prevention of industrial accidents. Hazardous processes and material. OSHA regulations and requirements. Design of accident prevention programs. *(Spring)*

CMET 6000. Special Topics in Construction Management. (3) Study of specific new areas emerging in the various fields of construction management. May be repeated for credit. *(On demand)*

CMET 6180. Alternative Project Delivery Methods. (3) A study of the many organizational arrangements between construction owners, designers, contractors, and financiers. Delivery methods studied include design-bid-build (DBB), design-build (DB), construction management (agency CM and CM@Risk), design-build-operate (DBO), and design-build-finance-operate (DBFO). *(Fall)*

CMET 6285. Quality Assurance in Construction. (3) Principles and applications of quantitative methods of quality control to production processes. Introduction to process control charts, Pareto charts, and other quality analysis tools for both construction and manufacturing industries. *(Spring)*

CMET 6290. Temporary Structures in Construction. (3) Study of temporary structures used to support construction operations such as concrete formwork, scaffolding systems, shoring systems, cofferdams, underpinning, slurry walls, and construction dewatering systems. *(On demand)*

CMET 6295. Design & Improvement of Construction Operations. (3) Design of construction operations based on productivity concepts. Techniques for collecting data, analyzing, and formulating solutions to improve construction operations. *(Spring)*

CMET 6800. Independent Study in Construction Management. (3) Prerequisite: Consent of graduate committee advisor. Individual investigation and exposition of results for a directed project in construction management. May be repeated for credit. *(On demand)*

CMET 6900. Master's Thesis & Research. (1 – 6) Prerequisite: Consent of graduate committee advisor. Individual investigation culminating in the preparation and presentation of a thesis. May be repeated for credit. *(On demand)*

FMET 5160. Research and Analytical Methods. (3) Prerequisite: STAT 1220 or consent of instructor. A focus on analytical and research techniques applicable to construction and facility management problems. Topics include defining research problems, experiment design, measurement, sampling, and analysis. *(Fall)*

FMET 5165. Building Energy Management. (3) Prerequisite: ETCE 3271 or ETME 3143 or consent of instructor. A focus on the integrated planning of energy efficient technologies for building environmental control systems. Introduction to the design, planning, and optimization of HVAC systems and technology needed to integrate the heating, cooling, natural ventilation, lighting, electricity, and building energy management systems into a building's structure and design. *(Fall)*

FMET 5270. Operation of Constructed Facilities. (3) Acquisition, operation, maintenance, and disposal of building systems, structures, permanent interiors, furniture, and equipment; grounds and other exterior elements. *(Spring)*

FMET 6000. Special Topics in Facilities Management. (3) Study of specific new areas emerging in the various fields of facility management. May be repeated for credit. *(On demand)*

FMET 6145. Facilities Management Financial Analysis. (3) Study of real property concepts, issues, and topics pertinent to the facility management professional. Fundamentals of commercial real estate investment, understanding market influences, contracts and property portfolio management. *(Fall)*

FMET 6155. Plant Instrumentation and Controls. (3) Design and analysis of industrial process control instrumentation. Topics include process control devices and process control applications associated with industrial instrumentation. *(Fall)*

FMET 6250. Asset Management for Facility Managers. (3) Understanding useful life of building and infrastructure systems and creating a process to manage their life cycles; emphasis on justifying and funding capital projects. *(Spring)*

FMET 6255. Advanced Plant Layout and Design. (3) Designing construction sites and facility plants with respect to material handling, equipment location, auxiliary services, capital requirements, safety, and personnel organization. (*On demand*)

FMET 6800. Independent Study in Facilities Management. (3) Prerequisite: Consent of graduate committee advisor. Individual investigation and exposition of results for a directed project in facility management. May be repeated for credit. (*On demand*)

FMET 6900. Master's Thesis & Research. (1 – 6) Prerequisite: Consent of graduate committee advisor. Individual investigation culminating in the preparation and presentation of a thesis. May be repeated for credit. (*On demand*)

B. JUSTIFICATION.

1. Identify the need addressed by the proposal and explain how the proposed action meets the need.

Construction Management is a program that prepares individuals to manage, coordinate, and supervise the construction process from concept development through project completion on timely and economic bases. Such programs include instruction in commercial, residential, mechanical, highway/heavy civil, electrical, environmental, industrial, and specialty construction; *facilities management*; project planning; budgeting and cost control; logistics and materials management; personnel management and labor relations; site safety; construction contracting; construction processes and techniques; organization and scheduling; and applicable codes and regulations [U.S. Dept. of Education's NCES CIP2000].

Facility management is a profession that encompasses multiple disciplines to ensure functionality of the built environment by integrating people, place, process and technology. The body of knowledge required for facility management degree programs include facility function (professional practice), human and environmental factors, planning and project management, finance, operation and maintenance, real estate, written and oral communication, information technology, quality management and assessment procedures (research and analytical methods), and integrative and problem solving skills [IFMA Standards for Recognized Programs]. *Construction management* was listed as a job responsibility by 71% of facility managers in an industry-wide survey [IFMA.org, Facilities Industry Survey, 2004]. As can be seen, there is a considerable overlap between the construction management and facility management professions.

More corporations, industries, and owners are demanding more full-service, turn-key procurement of their physical infrastructure and associated operations and maintenance. As a result, more construction industry professionals are being asked to manage and deliver design, construction, and facility operations and maintenance services. In order to keep abreast of the ever increasing and expanding knowledge of materials, methods, and technology in this broad field requires advance training and education beyond the baccalaureate degree level. To fill this need, the Department of Engineering Technology

proposes the creation of a Master of Science in Construction and Facilities Management (MSCFM) degree program.

The proposed new degree program is unique in that it will be the first integrated construction and facility management graduate degree program in the University of North Carolina system. Currently, there are three other schools with master degree programs in construction management (ECU, WCU, & NCA&T) and no schools with facility management master degree programs. The proposed MSCFM program differs from the other construction management graduate programs because of its increased facility management focus and because it is designed to serve students and industry within the Charlotte Metropolitan area of the State. With the proposed MSCFM program, UNC Charlotte will also be one of only five schools in the nation to host a facility management graduate degree program joining the ranks of such prestigious institutions as Cornell University, Georgia Institute of Technology, and the University of Florida.

The Bureau of Labor Statistics' 2007-08 Edition of the Occupational Outlook Handbook [OOH] indicates that construction managers held 487,000 jobs in 2006 and employment is projected to increase by 16 percent during the 2006-16 decade, faster than the average for all occupations, because the number of job openings exceeds the number of qualified individuals seeking to enter the occupation. This situation is expected to continue even as college construction management programs expand to meet the current high demand for graduates. Currently, there are an estimated 2,190 construction managers in the Charlotte Metropolitan Region earning a mean annual salary of \$81,830 according to the 2006 Metropolitan Area Occupational Employment and Wage Estimates [MAOEWE] for the metropolitan area of Charlotte-Gastonia-Rock Hill, NC-SC.

About 60 colleges and universities offer a master's degree program in construction management or construction science. Master's degree recipients, especially those with work experience in construction, typically become construction managers in very large construction or construction management companies. Often, individuals who hold a bachelor's degree in an unrelated field seek a master's degree in construction management or construction science to work in the construction industry [OOH]. The MSCFM program will assist working professionals in obtaining this additional education.

Similarly, the job outlook for facility managers is also good. The number of jobs for administrative services managers, of which facility managers are a subset, is projected to grow 12 percent over the 2006-16 decade, about as fast as the average for all occupations. However, demand should be stronger for facility managers because businesses increasingly realize the importance of maintaining, securing, and efficiently operating their facilities, which are very large investments for most organizations [OOH]. Currently, there are an estimated 1,180 administrative services managers in the Charlotte Metropolitan Region earning a mean annual salary of \$67,130 [MAOEWE].

Most facility managers have an undergraduate or graduate degree in engineering, architecture, construction management, business administration, or facility management. Many have a background in real estate, construction, or interior design, in addition to

managerial experience. Advancement of facility managers is based on the practices and size of individual companies. Completion of the competency-based professional Certified Facility Manager (CFM) certification program offered by the International Facility Management Association can give prospective candidates an advantage. In order to qualify for this designation, applicants must meet certain educational and experience requirements [OOH]. The MSCFM program will assist working professionals in attaining the additional educational knowledge required for the CFM certification.

UNC Charlotte sits in a unique place from geographic, demographic, and business perspectives for a construction and facilities management program. The institution provides educational opportunities to residents of the largest metropolitan area in North Carolina. Charlotte is home to one of the most robust construction climates in North America. In addition to its large construction industry, Mecklenburg County and the surrounding metropolitan area are home to nine of the Fortune 500 companies. This ranks Charlotte 6th nationally in number of Fortune 500 companies headquartered within the county. These headquarters represent more than \$267.3 billion in revenue for 2006. More importantly, 328 of the Fortune 500 companies have made a commitment to the city by placing one or more of their facilities within the county [Charlotte Chamber of Commerce].

These 328 Fortune 500 companies represent a diverse range of industries such as energy, commercial banking, automotive retailing, steel fabrication, electronics, aerospace and defense, general merchandisers, and specialty retailers. Each of these companies maintains and operates numerous facilities that require experienced and trained facility management professionals. In addition, there are numerous smaller companies and industries within the region that also require facility management services.

This robust economic climate for construction and business services in the Charlotte region make UNC Charlotte an ideal fit for a Masters in Science of Construction and Facilities Management degree program. UNC Charlotte's Department of Engineering Technology has provided quality technical education for over 30 years. Our programs have met rigorous standards for specialized accreditation, and we have a long history of working with the Charlotte area construction industry to supply graduates for the greater Charlotte region and throughout North Carolina. This proposed program will only enhance the Department's outreach and integration with the community, enlarge its scholarly research capacity, and produce much needed graduates for the Charlotte construction and business community.

2. Discuss prerequisites/corequisites for course(s) including class-standing.

Students are required to hold a baccalaureate degree in construction management, facility management, engineering technology, engineering, or similar related fields. All courses require graduate standing and acceptance into the MSCFM degree program.

Common core 5000 level courses are required for all students in the degree program and serve as prerequisites for 6000 level elective courses. Additional course specific

prerequisites have been established to ensure students have adequate fundamentals to successfully complete the course. Students not satisfying the prerequisites or lacking the required background will be required to remediate the deficiency prior to enrolling in the course.

CMET/FMET 6900 Master's thesis and research courses require departmental approval and are reserved and required for graduate students' participating in externally sponsored research projects. All other students are required to complete the non-thesis degree option.

3. Demonstrate that course numbering is consistent with the level of academic advancement of students for whom it is intended.

Course numbers have been established that correspond with Graduate School catalog guidelines. Although initially all courses will be open only to graduate students, the common core courses have been given 5000 level designations in order to reserve the future possibility of cross-listing the courses as 4000 level major elective undergraduate courses.

4. In general, how will this proposal improve the scope, quality and/or efficiency of programs and/or instruction?

The MSCFM program will strengthen the existing degree programs in the Department of Engineering Technology. Academic infrastructure is in place to support laboratory experiences and computing needs of the program. The existing construction management (BSCM) and engineering technology programs (BSET) are growing quickly (Fall 2008 headcount enrollments are estimated at approximately 780 undergraduate students in the Department) and will benefit from the synergy of the proposed MSCFM program. The program will enlarge the scholarly and research capacity of the faculty. As the Department's programs represent popular and lucrative career opportunities which are technologically-based and appeal to today's college-bound population, data indicate that this proposed program and all existing engineering technology programs will continue to grow at UNC Charlotte.

C. IMPACT.

1. What group(s) of students will be served by this proposal? (Undergraduate and/or graduate; majors and/or non-majors, others? Explain). Describe how you determine which students will be served.

The MSCFM degree program will serve admitted graduate students holding a baccalaureate degree in construction management, facility management, engineering technology, engineering, or similar related fields.

2. What effect will this proposal have on existing courses and curricula?
 - a. When and how often will added course(s) be taught?

Once the MSCFM degree program is fully established and enrolled, the required core courses will be offered once a year in the semester indicated in the course description catalog copy. Elective courses will be offered on an on-demand basis depending on student interest. At full projected enrollment, it is anticipated that most elective courses will also be offered once every year or every other year.

b. How will the content and/or frequency of offering of other courses be affected?

As a new graduate degree program that does not share any existing courses, the MSCFM degree program should not have any impact on the content or frequency of offering of other courses.

c. What is the anticipated enrollment in course(s) added (for credit and auditors)?

Project enrollments for the MSCFM program are as follows:

	Year 1: 2009-10	Year 2: 2010-11	Year 3: 2011-12	Year 4: 2012-13
Full-time	6	15	25	35
Part-time	8	16	24	30

Based on these program projections, courses will have anticipated enrollments of 20 to 30 students each once the program is established.

d. How will enrollment in other courses be affected? How did you determine this?

As a new graduate degree program that does not share any existing courses, the MSCFM degree program should have little, if any, impact on the enrollment of other courses. There may be a slight increase in enrollment in select departmental undergraduate courses as some students remediate prerequisite or program deficiencies.

e. If course(s) has been offered previously under special topics numbers, give details of experience including number of times taught and enrollment figures.

The only course offered previously as a special topics course is FMET 5165 – Building Energy Management. The course was offered as an undergraduate major elective course in Spring 2008. Enrollment in the course was 32 students.

f. Identify other areas of catalog copy that would be affected, e.g., curriculum outlines, requirements for the degree, etc.

Additional catalog copy affected includes degree requirements and curriculum descriptions as indicated below:

Engineering Technology

- **MS in Construction and Facilities Management (MSCFM)**
- **Master's in Fire Protection & Administration (MFPA)**

Department of Engineering Technology

274 Smith Building
704-687-2305
www.et.uncc.edu

Graduate Director

Dr. Anthony L. Brizendine

Graduate Faculty

Anthony L. Brizendine, Professor & Chair
Rosida Coowar, Associate Professor
Chung-Suk Cho, Assistant Professor
David S. Cottrell, Assistant Professor
G. Bruce Gehrig, Associate Professor
John Hildreth, Assistant Professor
Steven Kuyath, Associate Professor
Maciej Noras, Assistant Professor
Carlos Orozco, Associate Professor
Peter Schmidt, Assistant Professor
Deborah Sharer, Associate Professor
Barry Sherlock, Professor
Jozef Urbas, Assistant Professor
Sheng-Gou Wang, Professor
Aixi Zhou, Assistant Professor

Faculty Emeritus

Cheng Liu, Professor Emeritus

Programs of Study

The Department of Engineering Technology provides opportunities for discipline-specific and multidisciplinary graduate-level education in construction and facilities management and closely related areas.

Advanced course work and research are used to enhance professional development, improve technical competency, and initiate a life-long learning experience.

MASTER OF SCIENCE IN CONSTRUCTION AND FACILITIES MANAGEMENT

Admission Requirements

- An earned undergraduate degree in construction management, facility management, engineering technology, engineering, architecture or a closely related field
- An undergraduate GPA of 3.0 or better
- Acceptable scores on the verbal, quantitative, and analytical sections of the GRE
- Positive letters of recommendation
- A combined TOEFL score of 220 (computer-based) or 557 (paper-based) is required if the previous degree was from a country where English is not the common language
- Other credentials as required by the Graduate School

Application Deadline

Applications can be received by the Graduate Admission Office any time prior to their published deadlines. In order to be considered for assistantships and tuition grants for the following academic year, students should apply by February 15 because the Department makes the first round of award decisions by March 15. However, the Department will evaluate admission applications at any time that complete applications are received by the Graduate School.

Assistantships

Research and teaching assistantships are available from the Department on a competitive basis to highly qualified applicants/students.

Tuition Grants

Tuition grants including out-of-state tuition differential waivers and in-state tuition support are available on a competitive basis for both out-of-state and in-state students, respectively.

Degree Requirements

A minimum of 30 approved graduate credit hours is required for graduation. At least 12 semester hours must be in courses numbered 6000 or above. A student may fulfill the 30-hour requirement by pursuing one of the two study options:

- a) 24 hours of course work plus 6 hours of thesis project
- b) 30 hours of course work and a comprehensive examination.

Admission to Candidacy Requirements

Each student is required to submit a Plan of Study to the Department's Graduate Director before completing 18 hours of graduate credits.

Upon completion of a substantial amount of graduate work, each student must file an Admission to Candidacy to the Graduate School by the published deadline for the semester of graduation.

Application for Degree

Each student should submit an Application for Degree prior to graduation. If a student does not graduate in the semester identified on the Application, the student must complete a new form and repay the application fee to be considered for graduation in a subsequent semester.

Transfer Credit

The Department accepts the transfer of graduate courses (6 credits maximum) taken at another institution or from UNC Charlotte prior to admission to the master's program in construction and facility management.

Core Courses

All students must complete the following 18 credit common core:

- CMET 5130 Building Information Modeling
- CMET 5135 Advanced Construction Planning & Management
- CMET 5240 Safety & Risk Management
- FMET 5160 Research and Analytical Methods
- FMET 5165 Building Energy Management
- FMET 5270 Operation of Constructed Facilities

Upon completion of the 18 credit hour common core students must select from either a construction management or facility management specialization. Students selecting the construction management option must complete the following 6 credit hour core:

- CMET 6180 Alternative Project Delivery Methods
- CMET 6285 Quality Assurance in Construction

Student selecting the facility management option must complete the following 6 credit hour core:

- FMET 6145 Facilities Management Financial Analysis
- FMET 6250 Asset Management for Facility Managers

Capstone Experiences

Students pursuing a master's degree in construction management and facility management have two options to complete the 30-credit hour program.

- a) 24 hours of course work plus 6 hours of thesis project
- b) 30 hours of course work and a comprehensive examination.

Both options require the formation of a program committee.

The thesis option is reserved for students performing research under formal graduate research or teaching assistantships. Students receiving such assistantships are required to pursue the thesis option. The thesis option requires students to submit a written thesis and orally defend their work before their program committee.

All non-thesis students must complete an additional 6 credit hours of major elective coursework within their technical specialty and to complete a formal comprehensive examination.

The comprehensive examination is a written exam. A student's exam will be scheduled when he/she has at least 24 hours of course credit completed or in progress. The student's graduate advisor and the examining committee will coordinate the examination (to be offered once in the Fall and once in the Spring semesters), preparing the exam with the assistance of members of the student's program committee. The exam will measure the student's mastery of theories and applications in the selected area of specialization within the discipline. Students will have only two opportunities to receive passing marks on the examination.

Advising

Each student is supervised by his/her graduate advisor and a program committee.

Program Committee

The Program Committee shall consist of at least three graduate faculty members. A graduate faculty from outside the ET department or from outside the

student's major area-of-study may serve as a member of the Program Committee. The student's ET graduate advisor shall chair the committee.

Research Opportunity/Experience

Students in construction and facility management enjoy a curriculum with opportunities for interdisciplinary research, study abroad, and active participation in a growing research program. Programs of study can be tailored to suit individual needs and interests. The ET web site (www.et.uncc.edu) provides current areas of research conducted by the program faculty.

COURSES IN CONSTRUCTION AND FACILITIES MANAGEMENT

CMET 5130. Building Information Modeling. (3)
Prerequisite: ETCE 1104 or ETGR 1104 or consent of instructor. A study of the creation, management, and application of building information models to the construction, operation, and maintenance of a facility. Focus will be on 2D and 3D computer models of building components, renderings, animations, and interfacing with analysis tools. *(Fall)*

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Causes and prevention of industrial accidents. Hazardous processes and material. OSHA regulations and requirements. Design of accident prevention programs. *(Spring)*

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arrangements between construction owners, designers, contractors, and financiers. Delivery methods studied include design-bid-build (DBB), design-build (DB), construction management (agency CM and CM@Risk), design-build-operate (DBO), and design-build-finance-operate (DBFO). *(Fall)*

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CMET 6900. Master's Thesis & Research. (1 – 6)
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Prerequisite: ETCE 3271 or ETME 3143 or consent of instructor. A focus on the integrated planning of energy efficient technologies for building environmental control systems. Introduction to the

design, planning, and optimization of HVAC systems and technology needed to integrate the heating, cooling, natural ventilation, lighting, electricity, and building energy management systems into a building's structure and design. *(Fall)*

FMET 5270. Operation of Constructed Facilities. (3) Acquisition, operation, maintenance, and disposal of building systems, structures, permanent interiors, furniture, and equipment; grounds and other exterior elements. *(Spring)*

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FMET 6255. Advanced Plant Layout and Design. (3) Designing construction sites and facility plants with respect to material handling, equipment location, auxiliary services, capital requirements, safety, and personnel organization. *(On demand)*

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D. RESOURCES REQUIRED TO SUPPORT PROPOSAL.

When added resources are not required, indicate “none”. For items which require “none” explain how this determination was made.

1. Personnel

- a.** Specify requirements for new faculty, part-time teaching, student assistant and/or increased load on present faculty.

It is anticipated that this new enrollment stream will warrant the addition of four new faculty members over the next four years to adequately deliver the program. Faculty in the Construction Management program will be added through the campus' faculty line allocation process. These positions will be justified through enrollment growth and student credit hour production targets being met. Additionally, research capability and production will increase as new faculty and graduate students are added.

No adverse effect is anticipated on current faculty loads. In fact, the addition of new faculty hires in this developing construction group will provide additional catalyst for construction research, scholarly publication, and community outreach activity.

- b.** List by name qualified faculty members interested in teaching the course(s).

Dr. Anthony L. Brizendine
Dr. Rosida Coowar
Dr. Chung-Suk Cho
Dr. David S. Cottrell
Dr. G. Bruce Gehrig
Dr. John Hildreth
Dr. Carlos Orozco
Dr. Peter Schmidt
Dr. Aixi Zhou

2. Physical Facility

The proposed MSCFM program will share facilities with the existing Construction Management, Civil ET and Mechanical ET programs in the Smith Building. Laboratories currently exist to support construction materials, surveying, computer drafting, cost estimating, structures, hydraulics, soils, asphalt, stress analysis, thermodynamics, and instrumentation. Additional laboratories are in development which will support the building systems area. Existing facilities are adequate to support the on-campus program at commencement and during the next decade.

3. Equipment and Supplies

Existing equipment and supplies are adequate to support the program.

4. Computer

Existing information technology services and MOSAIC engineering computing capabilities are adequate to support the program.

5. Audio-Visual

Existing audio-visual capabilities are adequate to support the program. Additional infrastructure to support future online, distance education delivery of the program is required. Estimates of additional IT infrastructure (hardware and software) to support delivery of the distance component are approximately \$550,000

6. Other Resources

Other additional resources are not required.

7. Indicate source(s) of funding for new/additional resources required to support this proposal.

Existing facilities and equipment are in place. Any additional new facilities or equipment will be funded through normal university funding sources to include projected funding from RFPs from General Administration. Supplemental funding from public and private sources to include construction industry support will be utilized for program enhancements.

E. CONSULTATION WITH THE LIBRARY AND OTHER DEPARTMENTS OR UNITS

1. Library Consultation

Present library holdings are adequate to support the proposed MSCFM program. A search of the online catalog in the area of construction and facility management retrieved 3817 pertinent items. This total includes 3412 books and government documents, 44 periodical subscriptions, and 454 electronic resources specific to this area. In addition, the library has approximately 40 electronic databases, many with links to full text articles. The required memorandum from the library summarizing its consultation concerning the MSCFM program is included in Attachment C.

2. Consultation with other departments or units

The following departments within the College of Engineering have been consulted concerning this proposal:

The Department of Civil and Environmental Engineering
The Department of Electrical and Computer Engineering
The Department of Mechanical Engineering and Engineering Science

Formal letters, memoranda or email correspondence of endorsement/support from these units are included in Attachment B.

F. INITIATION AND CONSIDERATION OF THE PROPOSAL

1. Originating Unit

This proposal was initiated by the faculty of the Department of Engineering Technology.

The following were consulted during the initiation of the intent to plan / request to establish process for this program:

- ET and CM Industrial Advisory Boards – Unanimous Support
- Department of Engineering Technology Faculty – Unanimous Vote in Favor
- Lee College of Engineering Academic Policy & Curriculum Committee (CEAPCC) – incorporated all suggestions
- Lee College of Engineering Dean – incorporated all suggestions

This course and curriculum proposal for the M.S.in Construction & Facilities Management received unanimous approval by vote from the faculty of the Department of Engineering Technology on September 2, 2008.

2. Other Considering Units

The course and curriculum proposal will be subject to the standard faculty governance review processes established by the Department of Engineering Technology, the College of Engineering, the Graduate School, and the University of North Carolina at Charlotte.

G. ATTACHMENTS

- 1. Attachment A: Graduate Course Descriptions and Syllabi.**
- 2. Attachment B: Consultation Documentation**

Attachment A: Graduate Course Descriptions and Syllabi

**PROPOSED COURSE DESCRIPTION AND SYLLABUS
CMET 5130 – BUILDING INFORMATION MODELING**

Proposed Catalog Description:

CMET 5130. Building Information Modeling. (3) Prerequisite: ETCE 1104 or ETGR 1104 or consent of instructor. A study of the creation, management, and application of building information models to the construction, operation, and maintenance of a facility. Focus will be on 2D and 3D computer models of building components, renderings, animations, and interfacing with analysis tools. *(Fall)*

Pre- or Co-requisites:

Prerequisite for course is an AutoCAD background equivalent to ETCE 1104 or ETGR 1104.

Objectives of the Course:

At the completion of the course students will be able to:

- Describe the components and tools used in building information and parametric modeling.
- Develop a building information model of a simple project.
- Assess the technical and economic impacts of building information modeling on the design, construction, and operation of facilities.

Instructional Method:

The course is presented in a lecture format which will include the following elements as appropriate: presentation of factual material in a standard lecture format, interactive demonstrations of methods to be applied in assignments, and opportunities for student questions, discussion, and presentations by students.

Means of Student Evaluation:

Students will be evaluated on their ability to answer factual questions regarding material presented in the class and assigned texts, to correctly solve problems using methods presented in the class, and to participate productively in critical discussion of course material. Student performance in the course will be evaluated on the following basis:

Homework:	15%
Mid-term Exam:	25%
Course Project:	25%
Final Exam:	25%
Participation:	10%

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Attendance

Attendance at lecture is required, although exceptions will be made for reasons such as illness or family emergency. Excessive absences will result in a reduced classroom participation score at the instructor's discretion, and will negatively impact the overall course grade.

3. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%
B = 80-90%
C = 70-80%
U = 0-70%

4. Homework and Assignments

All homework and assignments are due on the dates determined by the instructor. No late homework will be accepted. Students must have a cumulative overall score of at least 80% on homework assignments in order to receive a passing grade for the course.

5. Electronic Devices

The use of cell phones, beepers, or other communication devices is disruptive, and is therefore prohibited during class. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Students are permitted to use computers during class for note-taking and other class-related work only. Those using computers during class for non-class related work will be asked to leave the classroom for the remainder of the class period.

Proposed Text:

BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors, C. Eastman, P. Teicholz, R. Sacks, and K. Liston, John Wiley & Sons, Inc., 2008, ISBN: 978-0-470-18528-5.

Or

Building Information Modeling, William Kymmell, McGraw Hill, 2008, ISBN: 978-0-071-49453-3.

Proposed Course Outline:

- Week 1: Introduction to Building Information Modeling
- Week 2: BIM Tools and Parametric Modeling
- Week 3: Interoperability and Exchange Formats
- Week 4: BIM Application Areas for Owners and Facility Managers
- Week 5: An Owner and Facility Manager's Building Model
- Week 6: BIM for Architects and Engineers
- Week 7: Building Element Models and Libraries
- Week 8: BIM for the Construction Industry
- Week 9: Integration with Cost, Schedule Control and Other Management Functions
- Week 10: BIM for Subcontractors and Fabricators
- Week 11: Adopting BIM in a Fabrication Operation
- Week 12: Future Trends in Building Information Modeling
- Week 13: BIM Case Studies & Class Project
- Week 14: BIM Case Studies & Class Project
- Week 15: BIM Case Studies & Class Project

PROPOSED COURSE DESCRIPTION AND SYLLABUS
CMET 5135 – ADVANCED CONSTRUCTION PLANNING & MANAGEMENT

Proposed Catalog Description:

CMET 5135. Advanced Construction Planning & Management. (3) Prerequisite: ETCE 4126 or consent of instructor. Advanced methods for planning and controlling construction projects. Topics will include resource allocation, leveling and management, critical path method (CPM) and project evaluation and review techniques (PERT) of scheduling, project controls through cost-schedule integration, and schedule compression. (*Fall*)

Pre- or Co-requisites:

Prerequisite for course is a project scheduling background equivalent to ETCE 4126.

Objectives of the Course:

At the completion of the course students will be able to:

- Prepare cost and resource loaded schedules.
- Perform both unconstrained and constrained resource leveling.
- Conduct schedule impact analyzes and prepare associated claim documentation.
- Incorporate risk and uncertainty into project schedules.

Instructional Method:

The course is presented in a lecture format which will include the following elements as appropriate: presentation of factual material in a standard lecture format, interactive demonstrations of methods to be applied in assignments, and opportunities for student questions, discussion, and presentations by students.

Means of Student Evaluation:

Students will be evaluated on their ability to answer factual questions regarding material presented in the class and assigned texts, to correctly solve problems using methods presented in the class, and to participate productively in critical discussion of course material. Student performance in the course will be evaluated on the following basis:

Homework:	15%
Mid-term Exam:	25%
Course Project:	25%
Final Exam:	25%
Participation:	10%

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Attendance

Attendance at lecture is required, although exceptions will be made for reasons such as illness or family emergency. Excessive absences will result in a reduced classroom participation score at the instructor's discretion, and will negatively impact the overall course grade.

3. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%
B = 80-90%
C = 70-80%
U = 0-70%

4. Homework and Assignments

All homework and assignments are due on the dates determined by the instructor. No late homework will be accepted. Students must have a cumulative overall score of at least 80% on homework assignments in order to receive a passing grade for the course.

5. Electronic Devices

The use of cell phones, beepers, or other communication devices is disruptive, and is therefore prohibited during class. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Students are permitted to use computers during class for note-taking and other class-related work only. Those using computers during class for non-class related work will be asked to leave the classroom for the remainder of the class period.

Proposed textual resources will be drawn from the following:

Construction Scheduling: Preparation, Liability, and Claims by J. Wickwire, T. Driscoll, S. Hulbut, and S. Hillman, 2nd Ed., 2003, ISBN 0-7355-2994-9.

And

Schedule Impact Analysis using CPM Schedules, by B. Henschel and J. Hildreth, Technical Report No. TR-07-01, Dept. of Civil and Environmental Engineering, Virginia Tech, Blacksburg, VA, 2007.

And

CPM in Construction Management by J. O'Brien and F. Plotnick,, 6th Ed., McGraw-Hill Professional, 2006, ISBN 0071457690.

Proposed Course Outline:

- Week 1: Contractual Specifications for Construction Schedules
- Week 2: Building Intelligence into a CPM Schedule
- Week 3: Cost Schedule Integration
- Week 4: Resource Leveling
- Week 5: Resource Constrained Scheduling
- Week 6: Schedule Crashing
- Week 7: Implications of Schedule Review
- Week 8: Schedule Updates and Revisions
- Week 9: Schedule Impact Analysis (SIA)
- Week 10: Impacts and Entitlement for Delay
- Week 11: Retrospective SIA Techniques
- Week 12: Contemporaneous SIA Techniques
- Week 13: Documenting Impacts and Delays
- Week 14: PERT
- Week 15: Monte Carlo Simulation in Scheduling

**PROPOSED COURSE DESCRIPTION AND SYLLABUS
CMET 5240 – SAFETY & RISK MANAGEMENT**

Proposed Catalog Description:

CMET 5240. Safety & Risk Management. (3) Causes and prevention of industrial accidents. Hazardous processes and material. OSHA regulations and requirements. Design of accident prevention programs. (*Spring*)

Pre- or Co-requisites:

None

Objectives of the Course:

At the completion of the course students will be able to:

- Articulate the professional and ethical responsibilities involved in workplace safety.
- Summarize OSHA construction standards and safety practices.
- Identify workplace hazards and risks.
- Formulate a construction safety and risk management program.

Instructional Method:

The course is presented in a lecture format which will include the following elements as appropriate: presentation of factual material in a standard lecture format, interactive demonstrations of methods to be applied in assignments, and opportunities for student questions, discussion, and presentations by students.

Means of Student Evaluation:

Students will be evaluated on their ability to answer factual questions regarding material presented in the class and assigned texts, to correctly solve problems using methods presented in the class, and to participate productively in critical discussion of course material. Student performance in the course will be evaluated on the following basis:

Homework:	15%
Mid-term Exam:	25%
Course Project:	25%
Final Exam:	25%
Participation:	10%

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Attendance

Attendance at lecture is required, although exceptions will be made for reasons such as illness or family emergency. Excessive absences will result in a reduced classroom participation score at the instructor's discretion, and will negatively impact the overall course grade.

3. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%

B = 80-90%

C = 70-80%

U = 0-70%

4. Homework and Assignments

All homework and assignments are due on the dates determined by the instructor. No late homework will be accepted. Students must have a cumulative overall score of at least 80% on homework assignments in order to receive a passing grade for the course.

5. Electronic Devices

The use of cell phones, beepers, or other communication devices is disruptive, and is therefore prohibited during class. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Students are permitted to use computers during class for note-taking and other class-related work only. Those using computers during class for non-class related work will be asked to leave the classroom for the remainder of the class period.

Proposed Text:

Construction Safety and Health, David L. Goetsch, Prentice Hall, 2003. ISBN: 0130932159.

Or

Construction Safety Planning (Industrial Health & Safety), David V. MacCollum, Wiley, 1995. ISBN: 0471286699.

Or

Construction Safety Management Systems, S. Rowlinson, Taylor & Francis, 2004. ISBN: 0415300630.

Or

Handbook of OSHA Construction Safety and Health, Second Edition, Charles D. Reese and James Vernon Eidson, CRC, 2006. ISBN: 0849365465.

Or

Industrial Safety and Risk Management, Laird Wilson and Doug McCutcheon, The University of Alberta Press, 2003. ISBN: 0888643942.

Proposed Course Outline:

- Week 1: The Cost of Accidents: Why Safety is Important
Roles of Construction Personnel in Safety and Health
Workers Compensation / Insurance
- Week 2: Regulations and Professional Responsibilities / Ethics and Safety
- Week 3: Accident Causation Theories / Human Factors
- Week 4: OSHA's Construction Standard and Corresponding Safety Practices
- Week 5: OSHA's Construction Standard and Corresponding Safety Practices
- Week 6: Safety and the Design Team
Safety and Risk Management in Contract Documents
- Week 7: Hazard Identification and Risk Assessment Techniques
- Week 8: Construction Safety and Risk Management Programs and Policies
- Week 9: Construction Safety and Risk Management Programs and Policies
- Week 10: Toxic and Hazardous Materials, Confined Spaces, and Respiratory Protection
- Week 11: Safety and Technology / Emergency Response Plans
- Week 12: Accident Investigation, Reporting, and Record Keeping
- Week 13: Total Safety Management (TSM)
- Week 14: Preventing Violence in the Workplace / Environmental Safety: ISO 14000
- Week 15: Future of Safety and Risk Management

**PROPOSED COURSE DESCRIPTION AND SYLLABUS
CMET 6000 – SPECIAL TOPICS IN CONSTRUCTION MANAGEMENT**

Proposed Catalog Description:

CMET 6000. Special Topics in Construction Management. (3) Study of specific new areas emerging in the various fields of construction management. May be repeated for credit. (*On demand*)

Pre- or Co-requisites:

Consent of graduate advisor

Objectives of the Course:

By the end of the course, students will be able to research and analyze problems in an emerging field of construction management.

Instructional Method:

The course is presented in a lecture format which will include the following elements as appropriate: presentation of factual material in a standard lecture format, interactive demonstrations of methods to be applied in assignments, and opportunities for student questions, discussion, and presentations by students.

Means of Student Evaluation:

Students will be evaluated on their ability to answer factual questions regarding material presented in the class and assigned texts, to correctly solve problems using methods presented in the class, and to participate productively in critical discussion of course material. Student performance in the course will be evaluated on the following basis:

Homework:	15%
Mid-term Exam:	25%
Course Project:	25%
Final Exam:	25%
Participation:	10%

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in

disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Attendance

Attendance at lecture is required, although exceptions will be made for reasons such as illness or family emergency. Excessive absences will result in a reduced classroom participation score at the instructor's discretion, and will negatively impact the overall course grade.

3. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%
B = 80-90%
C = 70-80%
U = 0-70%

4. Homework and Assignments

All homework and assignments are due on the dates determined by the instructor. No late homework will be accepted. Students must have a cumulative overall score of at least 80% on homework assignments in order to receive a passing grade for the course.

5. Electronic Devices

The use of cell phones, beepers, or other communication devices is disruptive, and is therefore prohibited during class. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Students are permitted to use computers during class for note-taking and other class-related work only. Those using computers during class for non-class related work will be asked to leave the classroom for the remainder of the class period.

Proposed Text:

Text to be selected based on course topic and instructor preference.

Proposed Course Outline:

Outline to be selected based on course topic and instructor preference.

**PROPOSED COURSE DESCRIPTION AND SYLLABUS
CMET 6180 – ALTERNATIVE PROJECT DELIVERY METHODS**

Proposed Catalog Description:

CMET 6180. Alternative Project Delivery Methods. (3) A study of the many organizational arrangements between construction owners, designers, contractors, and financiers. Delivery methods studied include design-bid-build (DBB), design-build (DB), construction management (agency CM and CM@Risk), design-build-operate (DBO), and design-build-finance-operate (DBFO). (*Fall*)

Pre- or Co-requisites:

None

Objectives of the Course:

At the completion of the course students will be able to:

- Develop project scope and performance criteria for integrated project delivery.
- Categorize and critique the alternative delivery strategies of design-bid-build, design build, construction management at risk, design-build-operate, and design-build-finance-operate.
- Select the appropriate project delivery method based on project scope and performance criteria.
- Understand the contractual, legal, and risk management aspects associated with alternative project delivery methodologies.

Instructional Method:

The course is presented in a lecture format which will include the following elements as appropriate: presentation of factual material in a standard lecture format, interactive demonstrations of methods to be applied in assignments, and opportunities for student questions, discussion, and presentations by students.

Means of Student Evaluation:

Students will be evaluated on their ability to answer factual questions regarding material presented in the class and assigned texts, to correctly solve problems using methods presented in the class, and to participate productively in critical discussion of course material. Student performance in the course will be evaluated on the following basis:

Homework:	15%
Mid-term Exam:	25%
Course Project:	25%
Final Exam:	25%

Participation: 10%

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Attendance

Attendance at lecture is required, although exceptions will be made for reasons such as illness or family emergency. Excessive absences will result in a reduced classroom participation score at the instructor's discretion, and will negatively impact the overall course grade.

3. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%
B = 80-90%
C = 70-80%
U = 0-70%

4. Homework and Assignments

All homework and assignments are due on the dates determined by the instructor. No late homework will be accepted. Students must have a cumulative overall score of at least 80% on homework assignments in order to receive a passing grade for the course.

5. Electronic Devices

The use of cell phones, beepers, or other communication devices is disruptive, and is therefore prohibited during class. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Students are permitted to use computers during class for note-taking and other class-related work only. Those using computers during class for non-class related work will be asked to leave the classroom for the remainder of the class period.

Proposed Text:

Preparing for Design-Build Projects: A Primer for Owners, Engineers, and Contractors, Douglas D. Gransberg, James E. Koch, and Keith R. Molenaar, American Society of Civil Engineers (ASCE) Press, ISBN 0-7844-0828-9

Or

Design-Build Project Delivery, Sidney M. Levy, McGraw Hill, 2006. ISBN-0-07-146157-4

Proposed Course Outline:

- Week 1: Introduction to Design and Construction Industries and Project Delivery Alternatives.
- Week 2: Basic Contracting Fundamentals: Traditional Project Delivery (Design–Bid–Build) and the Search for a Better System.
- Week 3: The Construction Manager’s Role: Meeting the Owner’s Needs.
- Week 4: Developing Project Scope based on Project Delivery Alternatives.
- Week 5: Introduction to Design-Build Project Delivery.
- Week 6: Writing Design-Build Performance Criteria.
- Week 7: Preparing Requests for Qualifications/Proposals for Project Delivery Alternatives.
- Week 8: Selection Process/Evaluation Planning for Request for Qualifications/Proposals.
- Week 9: Request for Proposal Case Studies.
- Week 10: Design-Build Contracts.
- Week 11: Project Delivery Alternative Proposal Evaluation Case Studies.
- Week 12: Sustainability and Project Delivery Alternatives.
- Week 13: Interoperability and Building Information Modeling (BIM).
- Week 14: Bonding and Insurance Considerations regarding Alternative Project Delivery.
- Week 15: The legal aspects of Alternative Project Delivery Methods.

**PROPOSED COURSE DESCRIPTION AND SYLLABUS
CMET 6285 – QUALITY ASSURANCE IN CONSTRUCTION**

Proposed Catalog Description:

CMET 6285. Quality Assurance in Construction. (3) Principles and applications of quantitative methods of quality control to production processes. Introduction to process control charts, Pareto charts, and other quality analysis tools for both construction and manufacturing industries. *(Spring)*

Pre- or Co-requisites:

None

Objectives of the Course:

At the completion of the course students will be able to:

- Articulate the principles, objectives, and techniques associated with Total Quality Management.
- Develop a data sampling system and conduct associated statistical testing and control.
- Prepare a project quality prepare.
- Measure, monitor and document process effectiveness and quality.

Instructional Method:

The course is presented in a lecture format which will include the following elements as appropriate: presentation of factual material in a standard lecture format, interactive demonstrations of methods to be applied in assignments, and opportunities for student questions, discussion, and presentations by students.

Means of Student Evaluation:

Students will be evaluated on their ability to answer factual questions regarding material presented in the class and assigned texts, to correctly solve problems using methods presented in the class, and to participate productively in critical discussion of course material. Student performance in the course will be evaluated on the following basis:

Homework:	15%
Mid-term Exam:	25%
Course Project:	25%
Final Exam:	25%
Participation:	10%

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Attendance

Attendance at lecture is required, although exceptions will be made for reasons such as illness or family emergency. Excessive absences will result in a reduced classroom participation score at the instructor's discretion, and will negatively impact the overall course grade.

3. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%
B = 80-90%
C = 70-80%
U = 0-70%

4. Homework and Assignments

All homework and assignments are due on the dates determined by the instructor. No late homework will be accepted. Students must have a cumulative overall score of at least 80% on homework assignments in order to receive a passing grade for the course.

5. Electronic Devices

The use of cell phones, beepers, or other communication devices is disruptive, and is therefore prohibited during class. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Students are permitted to use computers during class for note-taking and other class-related work only. Those using computers during class for non-class related work will be asked to leave the classroom for the remainder of the class period.

Proposed Text:

Quality Management in Construction, Brian Thorpe and Peter Sumner, Gower Publishing Company, 2005. ISBN: 056608614X.

Or

Construction Quality Management, Siu Lam Tang, Syed M. Ahmed, Raymond T. Aoieong, and Sun Wah Poon, University of Washington Press, 2005. ISBN: 962-209-746-4.

Or

Quality Control, Eighth Edition, Dale H. Besterfield, Prentice Hall, 2009. ISBN: 0-13-500095-5.

Or

Introduction to Engineering Construction Inspection, Edward R. Fisk and Randy R. Rapp, Wiley, 2004. ISBN:978-0-471-20167-0.

Proposed Course Outline:

- Week 1: Introduction to Quality and Total Quality Management
- Week 2: Total Quality Management – Principles and Objectives
- Week 3: Total Quality Management – Tools and Techniques
- Week 4: Fundamentals of Statistics and Control Charts
- Week 5: Sampling Systems/Techniques and Reliability
- Week 6: Management and Planning Tools
- Week 7: Establishing a QMS and the Role of the Quality Manager
- Week 8: Establishing a QMS and the Role of the Quality Manager
- Week 9: Applying the QMS to Project Work – Project Quality Plans
- Week 10: Applying the QMS to Project Work – Project Quality Plans
- Week 11: Monitoring Business and Process Effectiveness
- Week 12: Quality Cost Measurement Techniques
- Week 13: Documentation: Records and Reports
- Week 14: Computers and Quality Management - Software
- Week 15: Future of Quality Management

**PROPOSED COURSE DESCRIPTION AND SYLLABUS
CMET 6290 – TEMPORARY STRUCTURES IN CONSTRUCTION**

Proposed Catalog Description:

CMET 6290. Temporary Structures in Construction. (3) Study of temporary structures used to support construction operations such as concrete formwork, scaffolding systems, shoring systems, cofferdams, underpinning, slurry walls, and construction dewatering systems. (*On demand*)

Pre- or Co-requisites:

None

Objectives of the Course:

At the completion of the course students will be able to:

- Analyze concrete formwork for walls, slabs and columns operations.
- Analyze scaffolding, falsework and shoring operations.
- Analyze underpinning and slurry wall operations.
- Analyze construction dewatering operations.

Instructional Method:

The course is presented in a lecture format which will include the following elements as appropriate: presentation of factual material in a standard lecture format, interactive demonstrations of methods to be applied in assignments, and opportunities for student questions, discussion, and presentations by students.

Means of Student Evaluation:

Students will be evaluated on their ability to answer factual questions regarding material presented in the class and assigned texts, to correctly solve problems using methods presented in the class, and to participate productively in critical discussion of course material. Student performance in the course will be evaluated on the following basis:

Homework:	15%
Mid-term Exam:	25%
Course Project:	25%
Final Exam:	25%
Participation:	10%

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Attendance

Attendance at lecture is required, although exceptions will be made for reasons such as illness or family emergency. Excessive absences will result in a reduced classroom participation score at the instructor's discretion, and will negatively impact the overall course grade.

3. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%

B = 80-90%

C = 70-80%

U = 0-70%

4. Homework and Assignments

All homework and assignments are due on the dates determined by the instructor. No late homework will be accepted. Students must have a cumulative overall score of at least 80% on homework assignments in order to receive a passing grade for the course.

5. Electronic Devices

The use of cell phones, beepers, or other communication devices is disruptive, and is therefore prohibited during class. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Students are permitted to use computers during class for note-taking and other class-related work only. Those using computers during class for non-class related work will be asked to leave the classroom for the remainder of the class period.

Proposed Text:

Handbook of Temporary Structures in Construction, 2nd edition, Ratay, Robert T., McGraw Hill, New York, 1996.

Or

Structural Wood Design: A Practice-Oriented Approach, 1st edition, Aghayere, A., Vigil, J., John Wiley & Sons, Inc., New Jersey, 2007

Or

Formwork for Concrete, 6th edition, Hurd, M. K., American Concrete Institute, Detroit, Michigan, 1995.

Proposed Course Outline:

Week 1:	Course introduction and structural analysis review
Week 2:	General objectives in formwork building
Week 3:	Timber design review
Week 4:	Overall planning for formwork materials and proprietary products
Week 5:	Loads and Pressure Form Design
Week 6:	Wall form design
Week 7:	Slab form design
Week 8:	Column form design
Week 9:	Design Tables
Week 10:	Building and erecting the formwork
Week 11:	Scaffolding falsework/shoring
Week 12:	Cofferdams
Week 13:	Underpinning diaphragm/slurry walls
Week 14:	Earth-retaining structures
Week 15:	Construction dewatering, ground Freezing

PROPOSED COURSE DESCRIPTION AND SYLLABUS
CMET 6295 – DESIGN & IMPROVEMENT OF CONSTRUCTION OPERATIONS

Proposed Catalog Description:

CMET 6295. Design & Improvement of Construction Operations. (3) Design of construction operations based on productivity concepts. Techniques for collecting data, analyzing, and formulating solutions to improve construction operations. (*Spring*)

Pre- or Co-requisites:

None

Objectives of the Course:

At the completion of the course students will be able to:

- Evaluate productivity on construction operations.
- Describe the fundamentals of earthmoving, cranes and material handling operations.
- Collect and analyze data for routine and repetitive operations.
- Perform pre-planning, analysis and improvement processes to the Operational Life Cycle of a project.

Instructional Method:

The course is presented in a lecture format which will include the following elements as appropriate: presentation of factual material in a standard lecture format, interactive demonstrations of methods to be applied in assignments, and opportunities for student questions, discussion, and presentations by students.

Means of Student Evaluation:

Students will be evaluated on their ability to answer factual questions regarding material presented in the class and assigned texts, to correctly solve problems using methods presented in the class, and to participate productively in critical discussion of course material. Student performance in the course will be evaluated on the following basis:

Homework:	15%
Mid-term Exam:	25%
Course Project:	25%
Final Exam:	25%
Participation:	10%

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Attendance

Attendance at lecture is required, although exceptions will be made for reasons such as illness or family emergency. Excessive absences will result in a reduced classroom participation score at the instructor's discretion, and will negatively impact the overall course grade.

3. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%
B = 80-90%
C = 70-80%
U = 0-70%

4. Homework and Assignments

All homework and assignments are due on the dates determined by the instructor. No late homework will be accepted. Students must have a cumulative overall score of at least 80% on homework assignments in order to receive a passing grade for the course.

5. Electronic Devices

The use of cell phones, beepers, or other communication devices is disruptive, and is therefore prohibited during class. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Students are permitted to use computers during class for note-taking and other class-related work only. Those using computers during class for non-class related work will be asked to leave the classroom for the remainder of the class period.

Proposed textual resources will be drawn from the following:

Productivity Improvement in Construction by C. Oglesby, H. Parker, and G. Howell, McGraw-Hill, 1989, ISBN 0070478023.

And

Construction Planning, Equipment, and Methods by R. Peurifoy, W. Ledbetter, and C. Schexnayder, 5th Ed., McGraw-Hill, 1996, ISBN 0070498369.

And

Simulation Modeling and Analysis by A. Law and W. Kelton, 4th Ed., McGraw-Hill, 2007, ISBN 780073294414.

Proposed Course Outline:

- Week 1: Planning for Equipment and Methods
- Week 2: Productivity in Construction
- Week 3: Engineering Fundamentals of Earthmoving
- Week 4: Engineering Fundamentals of Cranes and Material Handling
- Week 5: Planning and Design of Routine and Repetitive Operations
- Week 6: Field Data Collection for Routine and Repetitive Operations
- Week 7: Stochastic Definitions of Operational Durations
- Week 8: Simulation Based Operations Analysis
- Week 9: Analysis and Interpretation of Statistical Simulation Results
- Week 10: Field Data Collection and Simulation Project
- Week 11: Planning and Design of Unique and Complex Operations
- Week 12: The Operational Life Cycle
- Week 13: Proactive Analysis
- Week 14: Reactive Analysis
- Week 15: Preplanning, Analysis, and Improvement Project

**PROPOSED COURSE DESCRIPTION AND SYLLABUS
CMET 6800 – INDEPENDENT STUDY IN CONSTRUCTION MANAGEMENT**

Proposed Catalog Description:

CMET 6800. Independent Study in Construction Management. (3) Prerequisite: Consent of graduate committee advisor. Individual investigation and exposition of results for a directed project in construction management. May be repeated for credit. (*On demand*)

Pre- or Co-requisites:

Consent of graduate committee advisor.

Objectives of the Course:

By the completion of this course students will be able to demonstrate proficiency in independently researching and completing a directed project in construction management.

Instructional Method:

No formal lecture. However, students will meet periodically over the course of the semester with their graduate advisor for mentoring and direction on their selected project.

Means of Student Evaluation:

Students will be evaluated based on the technical accuracy and completeness of their directed project.

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%
B = 80-90%
C = 70-80%
U = 0-70%

Proposed Text:

None

Proposed Course Outline:

None

**PROPOSED COURSE DESCRIPTION AND SYLLABUS
CMET 6900 – MASTER’S THESIS & RESEARCH**

Proposed Catalog Description:

CMET 6900. Master’s Thesis & Research. (1 – 6) Prerequisite: Consent of graduate committee advisor. Individual investigation culminating in the preparation and presentation of a thesis. May be repeated for credit. (*On demand*)

Pre- or Co-requisites:

Consent of graduate committee advisor.

Objectives of the Course:

By the completion of this course students will be able to demonstrate proficiency in independently researching, completing and defending a thesis quality project in construction management.

Instructional Method:

No formal lecture. However, students will meet periodically over the course of the project with their graduate advisor for mentoring and direction on their research project.

Means of Student Evaluation:

Students will be expected to prepare a formal written research thesis and to successfully present and defend their research in front of their graduate committee.

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Grading Policy

Grades will be assigned on the following scale:

A = Successful defense of research thesis
U = Unsuccessful defense of research thesis

Proposed Text:

None

Proposed Course Outline:

None

**PROPOSED COURSE DESCRIPTION AND SYLLABUS
FMET 5160 – RESEARCH AND ANALYTICAL METHODS**

Proposed Catalog Description:

FMET 5160. Research and Analytical Methods. (3) Prerequisite: STAT 1220 or consent of instructor. A focus on analytical and research techniques applicable to construction and facility management problems. Topics include defining research problems, experiment design, measurement, sampling, and analysis. (*Fall*)

Pre- or Co-requisites:

Prerequisite for course is an analytical statistical background equivalent to STAT 1220.

Objectives of the Course:

At the completion of the course students will be able to:

- Formulate experimental and Quasi-experimental designs.
- Evaluate the reliability and validity of collected data.
- Perform multivariate data analysis.
- Report results, inferences and conclusions in appropriate professional and ethical formats.

Instructional Method:

The course is presented in a lecture format which will include the following elements as appropriate: presentation of factual material in a standard lecture format, interactive demonstrations of methods to be applied in assignments, and opportunities for student questions, discussion, and presentations by students.

Means of Student Evaluation:

Students will be evaluated on their ability to answer factual questions regarding material presented in the class and assigned texts, to correctly solve problems using methods presented in the class, and to participate productively in critical discussion of course material. Student performance in the course will be evaluated on the following basis:

Homework:	15%
Mid-term Exam:	25%
Course Project:	25%
Final Exam:	25%
Participation:	10%

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Attendance

Attendance at lecture is required, although exceptions will be made for reasons such as illness or family emergency. Excessive absences will result in a reduced classroom participation score at the instructor's discretion, and will negatively impact the overall course grade.

3. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%

B = 80-90%

C = 70-80%

U = 0-70%

4. Homework and Assignments

All homework and assignments are due on the dates determined by the instructor. No late homework will be accepted. Students must have a cumulative overall score of at least 80% on homework assignments in order to receive a passing grade for the course.

5. Electronic Devices

The use of cell phones, beepers, or other communication devices is disruptive, and is therefore prohibited during class. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Students are permitted to use computers during class for note-taking and other class-related work only. Those using computers during class for non-class related work will be asked to leave the classroom for the remainder of the class period.

Proposed Text:

Research Methods for Construction, 3rd Edition, Fellows R. F. and Liu A. M., Wiley-Blackwell, 2008. ISBN: 978-1-4051-7790-0.

Or

Management Research Methods, Tharenou, P., and Cooper, B. , Cambridge University Press, 2007. ISBN: 9780521694285.

Or

Selected reference material from the *ASCE Journal of Construction Engineering and Management*, the *Journal of Construction Management and Economics*, the internet, and other resources.

Proposed Course Outline:

- Week 1: Introduction
- Week 2: The Research Process
- Week 3: Experimental and Quasi-experimental Designs
- Week 4: Correlational field study (survey) designs
- Week 5: Methods of Data Collection
- Week 6: Measurement
- Week 7: Reliability and Validity
- Week 8: Methods of Data Analysis
- Week 9: Quantitative Data
- Week 10: Data set up and Initial Analysis
- Week 11: Multivariate Data Analysis
- Week 12: Content Analysis
- Week 13: Reporting Results
- Week 14: Results Inferences and Conclusions
- Week 15: Ethical Issues

PROPOSED COURSE DESCRIPTION AND SYLLABUS FMET 5165 – BUILDING ENERGY MANAGEMENT

Proposed Catalog Description:

FMET 5165. Building Energy Management. (3) Prerequisite: ETCE 3271 or ETME 3143 or consent of instructor. A focus on the integrated planning of energy efficient technologies for building environmental control systems. Introduction to the design, planning, and optimization of HVAC systems and technology needed to integrate the heating, cooling, natural ventilation, lighting, electricity, and building energy management systems into a building's structure and design. (Fall)

Pre- or Co-requisites:

Prerequisite for course is a building systems or thermodynamics background equivalent to ETCE 3271 or ETME 3143.

Objectives of the Course:

At the completion of the course students will be able to:

- Conduct energy audits and evaluate associated energy billing and rate structures.
- Evaluate the energy efficiency of the building envelope and environmental systems including lighting, HVAC, and power plant.
- Analyze potential renewable energy and sustainability processes and improvements.

Instructional Method:

The course is presented in a lecture format which will include the following elements as appropriate: presentation of factual material in a standard lecture format, interactive demonstrations of methods to be applied in assignments, and opportunities for student questions, discussion, and presentations by students.

Means of Student Evaluation:

Students will be evaluated on their ability to answer factual questions regarding material presented in the class and assigned texts, to correctly solve problems using methods presented in the class, and to participate productively in critical discussion of course material. Student performance in the course will be evaluated on the following basis:

Homework:	15%
Mid-term Exam:	25%
Course Project:	25%
Final Exam:	25%
Participation:	10%

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Attendance

Attendance at lecture is required, although exceptions will be made for reasons such as illness or family emergency. Excessive absences will result in a reduced classroom participation score at the instructor's discretion, and will negatively impact the overall course grade.

3. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%
B = 80-90%
C = 70-80%
U = 0-70%

4. Homework and Assignments

All homework and assignments are due on the dates determined by the instructor. No late homework will be accepted. Students must have a cumulative overall score of at least 80% on homework assignments in order to receive a passing grade for the course.

5. Electronic Devices

The use of cell phones, beepers, or other communication devices is disruptive, and is therefore prohibited during class. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Students are permitted to use computers during class for note-taking and other class-related work only. Those using computers during class for non-class related work will be asked to leave the classroom for the remainder of the class period.

Proposed Text:

Guide to Energy Management, Barney Caphart, Wayne C. Turner and W.J. Kennedy, The Fairmont Press, Inc., 2006. ISBN: 0-88173-563-9.

Proposed Course Outline:

Week 1:	Introduction to Energy Management
Week 2:	Energy Audits and Instrumentation
Week 3:	Energy Billing and Rate Structures
Week 4:	Engineering Economics
Week 5:	Energy Efficient Lighting
Week 6:	HVAC Systems
Week 7:	Insulation
Week 8:	Energy Audit Project
Week 9:	Boilers and Steam Systems
Week 10:	Motors and Drives
Week 11:	Maintenance
Week 12:	Waste Heat Recovery
Week 13:	Thermal Energy Storage
Week 14:	Compressed Air System Optimization
Week 15:	Renewable Energy

**PROPOSED COURSE DESCRIPTION AND SYLLABUS
FMET 5270 – OPERATION OF CONSTRUCTED FACILITIES**

Proposed Catalog Description:

FMET 5270. Operation of Constructed Facilities. (3) Acquisition, operation, maintenance, and disposal of building systems, structures, permanent interiors, furniture, and equipment; grounds and other exterior elements. (*Spring*)

Pre- or Co-requisites:

None

Objectives of the Course:

At the completion of the course students will be able to:

- Prepare plans and schedules for facility maintenance work.
- Prepare and analyze records for facility preventative maintenance work and operations.
- Evaluate maintenance productivity and formulate continuous improvement plans.

Instructional Method:

The course is presented in a lecture format which will include the following elements as appropriate: presentation of factual material in a standard lecture format, interactive demonstrations of methods to be applied in assignments, and opportunities for student questions, discussion, and presentations by students.

Means of Student Evaluation:

Students will be evaluated on their ability to answer factual questions regarding material presented in the class and assigned texts, to correctly solve problems using methods presented in the class, and to participate productively in critical discussion of course material. Student performance in the course will be evaluated on the following basis:

Homework:	15%
Mid-term Exam:	25%
Course Project:	25%
Final Exam:	25%
Participation:	10%

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Attendance

Attendance at lecture is required, although exceptions will be made for reasons such as illness or family emergency. Excessive absences will result in a reduced classroom participation score at the instructor's discretion, and will negatively impact the overall course grade.

3. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%
B = 80-90%
C = 70-80%
U = 0-70%

4. Homework and Assignments

All homework and assignments are due on the dates determined by the instructor. No late homework will be accepted. Students must have a cumulative overall score of at least 80% on homework assignments in order to receive a passing grade for the course.

5. Electronic Devices

The use of cell phones, beepers, or other communication devices is disruptive, and is therefore prohibited during class. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Students are permitted to use computers during class for note-taking and other class-related work only. Those using computers during class for non-class related work will be asked to leave the classroom for the remainder of the class period.

Proposed Text:

Facility Managers Operations and Maintenance Handbook, Bernard T. Lewis, McGraw Hill Professional, 1999, ISBN: 978-0-070-40048-1.

Or

Maintenance Manager's Standard Manual, 3rd Edition, Thomas A. Westerkamp, BNI Publications, 2007, ISBN: 978-1-557-01602-7.

Or

Operations and Maintenance Competency Course Manual, International Facility Management Association

Proposed Course Outline:

- Week 1: Planning and Scheduling Maintenance Work
- Week 2: Facility Space Planning Justification and Construction
- Week 3: Material Planning
- Week 4: Equipment Records and Preventative Maintenance
- Week 5: Common Maintenance Operations and Tools
- Week 6: Structural Maintenance
- Week 7: Mechanical Maintenance
- Week 8: Electrical/Electronics Maintenance and Instrument Repair
- Week 9: Maintaining Roads and Grounds
- Week 10: Power Plant Maintenance
- Week 11: Maintenance Machining Fabrication and Painting
- Week 12: Housekeeping, Waste Management, Air and Water Quality, and Safety
- Week 13: Maintenance Work Measurement
- Week 14: Computer Applications in Maintenance
- Week 15: Maintenance Productivity Evaluation and Improvement

**PROPOSED COURSE DESCRIPTION AND SYLLABUS
FMET 6000 – SPECIAL TOPICS IN FACILITIES MANAGEMENT**

Proposed Catalog Description:

FMET 6000. Special Topics in Facilities Management. (3) Study of specific new areas emerging in the various fields of facility management. May be repeated for credit. *(On demand)*

Pre- or Co-requisites:

Approval of graduate committee advisor

Objectives of the Course:

By the end of the course, students will be able to research and analyze problems in an emerging field of facility management.

Instructional Method:

The course is presented in a lecture format which will include the following elements as appropriate: presentation of factual material in a standard lecture format, interactive demonstrations of methods to be applied in assignments, and opportunities for student questions, discussion, and presentations by students.

Means of Student Evaluation:

Students will be evaluated on their ability to answer factual questions regarding material presented in the class and assigned texts, to correctly solve problems using methods presented in the class, and to participate productively in critical discussion of course material. Student performance in the course will be evaluated on the following basis:

Homework:	15%
Mid-term Exam:	25%
Course Project:	25%
Final Exam:	25%
Participation:	10%

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth

in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Attendance

Attendance at lecture is required, although exceptions will be made for reasons such as illness or family emergency. Excessive absences will result in a reduced classroom participation score at the instructor's discretion, and will negatively impact the overall course grade.

3. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%
B = 80-90%
C = 70-80%
U = 0-70%

4. Homework and Assignments

All homework and assignments are due on the dates determined by the instructor. No late homework will be accepted. Students must have a cumulative overall score of at least 80% on homework assignments in order to receive a passing grade for the course.

5. Electronic Devices

The use of cell phones, beepers, or other communication devices is disruptive, and is therefore prohibited during class. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Students are permitted to use computers during class for note-taking and other class-related work only. Those using computers during class for non-class related work will be asked to leave the classroom for the remainder of the class period.

Proposed Text:

Text to be selected based on course topic and instructor preference.

Proposed Course Outline:

Outline to be selected based on course topic and instructor preference.

PROPOSED COURSE DESCRIPTION AND SYLLABUS
FMET 6145 – FACILITIES MANAGEMENT FINANCIAL ANALYSIS

Proposed Catalog Description:

FMET 6145. Facilities Management Financial Analysis. (3) Study of real property concepts, issues, and topics pertinent to the facility management professional. Fundamentals of commercial real estate investment, understanding market influences, contracts and property portfolio management. *(Fall)*

Pre- or Co-requisites:

None

Objectives of the Course:

At the completion of the course students will be able to:

- Interpret financial statements.
- Calculate return-on-investment and perform time value of money analyzes.
- Analyze, select, monitor, and evaluate projects and investments.
- Outline an effective contracts and property portfolio management plan.

Instructional Method:

The course is presented in a lecture format which will include the following elements as appropriate: presentation of factual material in a standard lecture format, interactive demonstrations of methods to be applied in assignments, and opportunities for student questions, discussion, and presentations by students.

Means of Student Evaluation:

Students will be evaluated on their ability to answer factual questions regarding material presented in the class and assigned texts, to correctly solve problems using methods presented in the class, and to participate productively in critical discussion of course material. Student performance in the course will be evaluated on the following basis:

Homework:	15%
Mid-term Exam:	25%
Course Project:	25%
Final Exam:	25%
Participation:	10%

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Attendance

Attendance at lecture is required, although exceptions will be made for reasons such as illness or family emergency. Excessive absences will result in a reduced classroom participation score at the instructor's discretion, and will negatively impact the overall course grade.

3. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%

B = 80-90%

C = 70-80%

U = 0-70%

4. Homework and Assignments

All homework and assignments are due on the dates determined by the instructor. No late homework will be accepted. Students must have a cumulative overall score of at least 80% on homework assignments in order to receive a passing grade for the course.

5. Electronic Devices

The use of cell phones, beepers, or other communication devices is disruptive, and is therefore prohibited during class. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Students are permitted to use computers during class for note-taking and other class-related work only. Those using computers during class for non-class related work will be asked to leave the classroom for the remainder of the class period.

Proposed Text:

Applied Economic Analysis for Technologists, Engineers, and Managers, 2nd Edition, Michael S. Bowman, Prentice Hall, 2003. ISBN-13: 9780130945112

Proposed Course Outline:

- Week 1: Introduction to Financial Concepts.
- Week 2: Introduction to Financial Statements and the Accounting Equation.
- Week 3: The Accounting Equation—Depreciation, Inventory, and Ratios.
- Week 4: Return on Investment and Single-Payment Calculations.
- Week 5: Annual Amount and Gradient Functions.
- Week 6: Time Value of Money Applications.
- Week 7: Analyzing, Selecting, Monitoring, and Evaluating Projects and Investments.
- Week 8: Financial Decision Making.
- Week 9: Breakeven Analysis.
- Week 10: Minimum Cost Analysis.
- Week 11: Replacement Analysis.
- Week 12: Taxes.
- Week 13: Continuous Financial Improvement.
- Week 14: Economics of Quality.
- Week 15: Continuous Financial Improvement.

**PROPOSED COURSE DESCRIPTION AND SYLLABUS
FMET 6155 – PLANT INSTRUMENTATION AND CONTROLS**

Proposed Catalog Description:

FMET 6155. Plant Instrumentation and Controls. (3) Design and analysis of industrial process control instrumentation. Topics include process control devices and process control applications associated with industrial instrumentation. *(Fall)*

Pre- or Co-requisites:

None

Objectives of the Course:

At the completion of the course students will be able to:

- Formulate instrumentation and controls design goals and plans.
- Analyze and design non-redundant and redundant sensor networks.
- Analyze and design non-repairable sensor networks.

Instructional Method:

The course is presented in a lecture format which will include the following elements as appropriate: presentation of factual material in a standard lecture format, interactive demonstrations of methods to be applied in assignments, and opportunities for student questions, discussion, and presentations by students.

Means of Student Evaluation:

Students will be evaluated on their ability to answer factual questions regarding material presented in the class and assigned texts, to correctly solve problems using methods presented in the class, and to participate productively in critical discussion of course material. Student performance in the course will be evaluated on the following basis:

Homework:	15%
Mid-term Exam:	25%
Course Project:	25%
Final Exam:	25%
Participation:	10%

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Attendance

Attendance at lecture is required, although exceptions will be made for reasons such as illness or family emergency. Excessive absences will result in a reduced classroom participation score at the instructor's discretion, and will negatively impact the overall course grade.

3. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%
B = 80-90%
C = 70-80%
U = 0-70%

4. Homework and Assignments

All homework and assignments are due on the dates determined by the instructor. No late homework will be accepted. Students must have a cumulative overall score of at least 80% on homework assignments in order to receive a passing grade for the course.

5. Electronic Devices

The use of cell phones, beepers, or other communication devices is disruptive, and is therefore prohibited during class. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Students are permitted to use computers during class for note-taking and other class-related work only. Those using computers during class for non-class related work will be asked to leave the classroom for the remainder of the class period.

Proposed Text:

Process Plant Instrumentation: Design and Upgrade, Miguel J. Bagajewicz, CRC Press, 2000.
ISBN-13: 9781566769983

Or

Instrumentation for Process Measurement and Control, 3rd Edition, Norman A. Anderson, CRC Press, 1997. ISBN-13: 9789849398711

Proposed Course Outline:

- Week 1: Plant Data Management.
- Week 2: Instrumentation Design Goals.
- Week 3: Instrumentation.
- Week 4: Errors in Measurement.
- Week 5: Non-redundant and Redundant Sensor Networks.
- Week 6: Design of Accurate Sensor Networks.
- Week 7: Precision Upgrade of Sensor Networks.
- Week 8: Reliability of Non-Repairable Sensor Networks.
- Week 9: Reliable Linear Non-repairable Sensor Networks.
- Week 10: Reliable Bilinear Non-repairable Sensor Networks.
- Week 11: Reliable and Cost Efficient Non-repairable Sensor Networks.
- Week 12: Repairable Sensor Networks.
- Week 13: Robust Sensor Networks.
- Week 14: Genetic Algorithms.
- Week 15: Sensors for Process Fault Diagnosis.

**PROPOSED COURSE DESCRIPTION AND SYLLABUS
FMET 6250. ASSET MANAGEMENT FOR FACILITY MANAGERS**

Proposed Catalog Description:

FMET 6250. Asset Management for Facility Managers. (3) Understanding useful life of building and infrastructure systems and creating a process to manage their life cycles; emphasis on justifying and funding capital projects. *(Spring)*

Pre- or Co-requisites:

None

Objectives of the Course:

At the completion of the course students will be able to:

- Prepare a facility needs assessment and portfolio management plan.
- Evaluate risk and uncertainty in facility management and formulate appropriate risk management plans.
- Develop disaster recovery, property maintenance and refurbishment plans.
- Evaluate and prepare justification plans for capital improvement projects.

Instructional Method:

The course is presented in a lecture format which will include the following elements as appropriate: presentation of factual material in a standard lecture format, interactive demonstrations of methods to be applied in assignments, and opportunities for student questions, discussion, and presentations by students.

Means of Student Evaluation:

Students will be evaluated on their ability to answer factual questions regarding material presented in the class and assigned texts, to correctly solve problems using methods presented in the class, and to participate productively in critical discussion of course material. Student performance in the course will be evaluated on the following basis:

Homework:	15%
Mid-term Exam:	25%
Course Project:	25%
Final Exam:	25%
Participation:	10%

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Attendance

Attendance at lecture is required, although exceptions will be made for reasons such as illness or family emergency. Excessive absences will result in a reduced classroom participation score at the instructor's discretion, and will negatively impact the overall course grade.

3. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%

B = 80-90%

C = 70-80%

U = 0-70%

4. Homework and Assignments

All homework and assignments are due on the dates determined by the instructor. No late homework will be accepted. Students must have a cumulative overall score of at least 80% on homework assignments in order to receive a passing grade for the course.

5. Electronic Devices

The use of cell phones, beepers, or other communication devices is disruptive, and is therefore prohibited during class. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Students are permitted to use computers during class for note-taking and other class-related work only. Those using computers during class for non-class related work will be asked to leave the classroom for the remainder of the class period.

Proposed Text:

Strategic Management of Built Facilities, Craig Langston and Rima-Lauge-Kirstensen, Butterworth-Heinemann, 2002. ISBN: 0750654406.

Or

Facility Design and Management Handbook, Eric Teicholz, McGraw-Hill Publishing, 2001.
ISBN: 0071353941

And

Appropriate Journal Articles

Proposed Course Outline:

- Week 1: Corporate Goals, Workplace Ecology and Worker Productivity
- Week 2: Strategic Facility Management
- Week 3: Space Planning
- Week 4: Needs Analysis and Portfolio Management
- Week 5: Risk Management
- Week 6: Risk and Uncertainty
- Week 7: Outsourcing
- Week 8: Continuity Planning and Disaster Recovery
- Week 9: Property Maintenance. Maintenance Planning
- Week 10: Obsolescence and Refurbishment
- Week 11: Value Management and Whole-of-life Assessment
- Week 12: Building in Value
- Week 13: Building Quality Assessment
- Week 14: Justification of Capital Projects
- Week 15: Capital Project Financing

**PROPOSED COURSE DESCRIPTION AND SYLLABUS
FMET 6255 – ADVANCED PLANT LAYOUT AND DESIGN**

Proposed Catalog Description:

FMET 6255. Advanced Plant Layout and Design. (3) Designing construction sites and facility plants with respect to material handling, equipment location, auxiliary services, capital requirements, safety, and personnel organization. *(On demand)*

Pre- or Co-requisites:

None

Objectives of the Course:

At the completion of the course students will be able to:

- Perform strategic facilities planning and management.
- Analyze and evaluate shipping, receiving, storage, and warehousing operations.
- Analyze and evaluate manufacturing and non-manufacturing operations.
- Evaluate sustainable processes in construction sites and facility plants.

Instructional Method:

The course is presented in a lecture format which will include the following elements as appropriate: presentation of factual material in a standard lecture format, interactive demonstrations of methods to be applied in assignments, and opportunities for student questions, discussion, and presentations by students.

Means of Student Evaluation:

Students will be evaluated on their ability to answer factual questions regarding material presented in the class and assigned texts, to correctly solve problems using methods presented in the class, and to participate productively in critical discussion of course material. Student performance in the course will be evaluated on the following basis:

Homework:	15%
Mid-term Exam:	25%
Course Project:	25%
Final Exam:	25%
Participation:	10%

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Attendance

Attendance at lecture is required, although exceptions will be made for reasons such as illness or family emergency. Excessive absences will result in a reduced classroom participation score at the instructor's discretion, and will negatively impact the overall course grade.

3. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%

B = 80-90%

C = 70-80%

U = 0-70%

4. Homework and Assignments

All homework and assignments are due on the dates determined by the instructor. No late homework will be accepted. Students must have a cumulative overall score of at least 80% on homework assignments in order to receive a passing grade for the course.

5. Electronic Devices

The use of cell phones, beepers, or other communication devices is disruptive, and is therefore prohibited during class. Except in emergencies, those using such devices must leave the classroom for the remainder of the class period. Students are permitted to use computers during class for note-taking and other class-related work only. Those using computers during class for non-class related work will be asked to leave the classroom for the remainder of the class period.

Proposed Text:

Sustainable Facilities Green design, Construction and Operations, Keith Moskow, Mc Graw Hill, 2008, ISBN 978-0-07-149474-8

And

Facilities Planning, James A. Tompkins and John White, Wiley, 1984, ISBN:0-471-03299-9

Or

Facilities Design and Handbook, 1st Edition, Eric Teicholz, McGraw Hill, 2001. ISBN: 0-07-135394-1.

Proposed Course Outline:

- Week 1: Introduction to Facility Management
- Week 2: Strategic Facilities Planning
- Week 3: Material Handling
- Week 4: Layout
- Week 5: Computer Aided Design
- Week 6: Shipping and Receiving
- Week 7: Storage and Warehousing
- Week 8: Manufacturing
- Week 9: Facility Services
- Week 10: Non-manufacturing Applications
- Week 11: Quantitative Approaches
- Week 12: Evaluating and Selecting the Facilities Plan
- Week 13: Implementing and Maintaining the Facilities Plan
- Week 14: Sustainable Facilities
- Week 15: Case Studies

**PROPOSED COURSE DESCRIPTION AND SYLLABUS
FMET 6800 – INDEPENDENT STUDY IN FACILITIES MANAGEMENT**

Proposed Catalog Description:

FMET 6800. Independent Study in Facilities Management. (3) Prerequisite: Consent of graduate committee advisor. Individual investigation and exposition of results for a directed project in facility management. May be repeated for credit. (*On demand*)

Pre- or Co-requisites:

Consent of graduate committee advisor.

Objectives of the Course:

By the completion of this course students will be able to demonstrate proficiency in independently researching and completing a directed project in facility management.

Instructional Method:

No formal lecture. However, students will meet periodically over the course of the semester with their graduate advisor for mentoring and direction on their selected project.

Means of Student Evaluation:

Students will be evaluated based on the technical accuracy and completeness of their directed project.

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Grading Policy

Grades will be assigned on the following scale:

A = 90-100%
B = 80-90%
C = 70-80%
U = 0-70%

Proposed Text:

None

Proposed Course Outline:

None

**PROPOSED COURSE DESCRIPTION AND SYLLABUS
FMET 6900 – MASTER’S THESIS & RESEARCH**

Proposed Catalog Description:

FMET 6900. Master’s Thesis & Research. (1 – 6) Prerequisite: Consent of graduate committee advisor. Individual investigation culminating in the preparation and presentation of a thesis. May be repeated for credit. (*On demand*)

Pre- or Co-requisites:

Consent of graduate committee advisor.

Objectives of the Course:

By the completion of this course students will be able to demonstrate proficiency in independently researching, completing and defending a thesis quality project in facility management.

Instructional Method:

No formal lecture. However, students will meet periodically over the course of the project with their graduate advisor for mentoring and direction on their research project.

Means of Student Evaluation:

Students will be expected to prepare a formal written research thesis and to successfully present and defend their research in front of their graduate committee.

Specific Course Policies:

The following policies apply to students in this course:

1. Academic Integrity

All students are required to read and abide by the Code of Student Academic Integrity. Violations of the Code of Student Academic Integrity, including plagiarism, will result in disciplinary action as provided in the Code. Definitions and examples of plagiarism are set forth in the Code. The Code is available from the Dean of Students Office or online at: <http://www.legal.uncc.edu/policies/ps-105.html>. A set of links to various resources on plagiarism and how to avoid it is available at the UNCC Library website: <http://library.uncc.edu/display/?dept=instruction&format=open&page=920>.

2. Grading Policy

Grades will be assigned on the following scale:

A = Successful defense of research thesis
U = Unsuccessful defense of research thesis

Proposed Text:

None

Proposed Course Outline:

None

Attachment B: Consultation Documentation



Consultation on Library Holdings

To: John Hildreth
From: Alison Bradley
Date: April 23, 2008
Subject: Master of Science in Construction and Facilities Management

Summary of Librarian's Evaluation of Holdings:

Evaluator: Alison Bradley Date: April 23, 2008

Check One:

- 1. Holdings are superior _____
- 2. Holdings are adequate x
- 3. Holdings are adequate only if Dept. purchases additional items. _____
- 4. Holdings are inadequate _____

Comments:

Current library holdings should be sufficient to support the proposed MS in Construction and Facilities Management. A search of the catalog shows that we currently own 3817 relevant items, with 3412 books and government documents, 44 periodical subscriptions, and 454 electronic resources (these numbers include some duplication). A summary of these holdings with the Library of Congress Subject Headings and keywords used to search is attached.

Additional research interests may be supported through the library's interlibrary loan services as well.

With anticipated ongoing purchases in this and related fields of study, library support for this degree should be sufficient to support research at the Master's level.

Alison Bradley

Evaluator's Signature

April 23, 2008

Date

Library Holdings Evaluation for Master of Science in Construction and Facilities Management

Prepared by Alison Bradley, April 23 2008

LC Subject Heading	Total			Electronic Resources
	Entries	Monographs	Periodicals	
Mechanics Applied	193	138	17	38
Building Laws	142	168	0	4
Earthwork	57	50	0	8
Engineering Econom*	74	70	0	6
Physical Geology	28	26	0	0
Project Management	437	376	0	65
Production Scheduling	71	61	0	2
Roads Design And Construction	275	271	0	10
Soils Testing	66	65	0	1
Structural Analysis Engineering	288	266	2	24
Structural Design	182	173	3	12
Structural Engineering	135	107	10	11
Keyword				
Construction Management	777	722	6	78
Building Code*	391	402	1	14
Construction Material*	701	517	5	181
Totals	3817	3412	44	454