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 17 new graduate level courses will be created and developed:

- CMET 5240 - Safety & Risk Management 3 credits
- CMET 5270 - Operation of Constructed Facilities 3 credits
- CMET 6000 - Special Topics in Construction & Facility Management 3 credits
- CMET 6130 - Building Information Modeling 3 credits
- CMET 6135 - Advanced Construction Planning & Management 3 credits
- CMET 6140 - Building Energy Management 3 credits
- CMET 6145 - Facilities Management Financial Analysis 3 credits
- CMET 6155 - Plant Instrumentation and Controls 3 credits
- CMET 6160 - Research and Analytical Methods 3 credits
- CMET 6180 - Alternative Project Delivery Methods 3 credits
- CMET 6250 - Asset Management for Facility Managers 3 credits
- CMET 6255 - Advanced Plant Layout and Design 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 & Facility Management 3 credits
- CMET 6900 - Master’s Thesis & Research 1 – 6 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 5240. Safety & Risk Management. (3) Prerequisite: CMET 4228 or consent of instructor. Causes and prevention of industrial accidents. Hazardous processes and material. OSHA regulations and requirements. Design of accident prevention programs. (*Spring*)

CMET 5270. Operation of Constructed Facilities. (3) Prerequisite: CMET 3224 and ETCE 3271 or consent of instructor. Acquisition, operation, maintenance, and disposal of building systems, structures, permanent interiors, furniture, and equipment; grounds and other exterior elements. (*Spring*)

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

CMET 6130. 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 6135. 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 6140. 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*)

CMET 6145. Facilities Management Financial Analysis. (3) Prerequisite: ETGR 3222 or ECON 2102 or consent of instructor. 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*)
CMET 6155. Plant Instrumentation and Controls. (3) Prerequisite: ETME 3163 or consent of instructor. Design and analysis of industrial process control instrumentation. Topics include process control devices and process control applications associated with industrial instrumentation. (Fall)

CMET 6160. 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)

CMET 6180. Alternative Project Delivery Methods. (3) Prerequisite CMET 3224 or consent of instructor. 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 6250. Asset Management for Facility Managers. (3) Prerequisite: CMET 5270 or consent of instructor. 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)

CMET 6255. Advanced Plant Layout and Design. (3) Prerequisite: CMET 5270 or consent of instructor. Designing construction sites and facility plants with respect to material handling, equipment location, auxiliary services, capital requirements, safety, and personnel organization. (On demand)

CMET 6285. Quality Assurance in Construction. (3) Prerequisite: CMET 6160 or consent of instructor. 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 the construction industry. (Spring)

CMET 6290. Temporary Structures in Construction. (3) Prerequisite: ETCE 3163 or consent of instructor. 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) Prerequisite: CMET 6135. 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 & Facility Management. (3) Prerequisite: Consent of graduate committee advisor. Individual investigation and exposition of results for a directed project in construction and facility 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)

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. If accredited, with the proposed MSCFM program, UNC Charlotte will join only three other schools in the nation hosting a facility management graduate degree program recognized by the IFMA: Cornell University, Georgia Institute of Technology, and the Pratt Institute [http://www.ifmafoundation.org/scholarships/degree.cfm]. The IFMA also lists the following five U.S. schools offering unrecognized facility management master level graduate programs [http://www.aia.org/SiteObjects/files/fm_ifma_programs.pdf]:

- Arizona State University
- Depaul University
- Indiana State University
- Michigan State University
- 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 6900 Master’s thesis and research course requires departmental approval and is 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 enrollments indicate approximately 750 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 a 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)?

   Projected enrollments for the MSCFM program are as follows:

<table>
<thead>
<tr>
<th></th>
<th>Year 1: 2009-10</th>
<th>Year 2: 2010-11</th>
<th>Year 3: 2011-12</th>
<th>Year 4: 2012-13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-time</td>
<td>6</td>
<td>15</td>
<td>25</td>
<td>35</td>
</tr>
<tr>
<td>Part-time</td>
<td>8</td>
<td>16</td>
<td>24</td>
<td>30</td>
</tr>
</tbody>
</table>

   Based on these projections, at fully established program enrollments courses will have anticipated enrollments of 20 to 40 students each.

   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 is the undergraduate version of CMET 6140 – Building Energy Management. The course (ETGR 3000) 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 Facility 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
David S. Cottrell, Assistant Professor
G. Bruce Gehrig, Associate Professor
John Hildreth, Assistant 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

Programs of Study
The Department of Engineering Technology provides opportunities for discipline-specific and multidisciplinary graduate-level education in construction and facility 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 FACILITY 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 2.75 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
• Integral and differential calculus (MATH 1120 or 1121 or ETGR 3171 at UNC Charlotte or equivalent from other institution).
• Other credentials as required by the Graduate School

Acceptability for admission is based upon the applicant's record and background as determined by the department.

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 15 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 6130 Building Information Modeling
- CMET 6135 Advanced Construction Planning & Management
- CMET 5240 Safety & Risk Management
- CMET 6140 Building Energy Management
- CMET 5270 Operation of Constructed Facilities
- CMET 6160 Research and Analytical Methods

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:

- CMET 6145 Facilities Management Financial Analysis
- CMET 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 FACILITY MANAGEMENT

CMET 5240. Safety & Risk Management. (3) Prerequisite: CMET 4228 or consent of instructor. Causes and prevention of industrial accidents. Hazardous processes and material. OSHA regulations and requirements. Design of accident prevention programs. (Spring)

CMET 5270. Operation of Constructed Facilities. (3) Prerequisite: CMET 3224 and ETCE 3271 or consent of instructor. Acquisition, operation, maintenance, and disposal of building systems, structures, permanent interiors, furniture, and equipment; grounds and other exterior elements. (Spring)

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CMET 6180. Alternative Project Delivery Methods. (3) Prerequisite: CMET 3224 or consent of instructor. 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 6250. Asset Management for Facility Managers. (3) Prerequisite: CMET 5270 or consent
of instructor. Understanding useful life of building and infrastructure systems and creating a process to manage their life cycles; emphasis on justifying and funding capital projects. \textit{(Spring)}

\textbf{CMET 6255. Advanced Plant Layout and Design.} (3) Prerequisite CMET 5270 or consent of instructor. Designing construction sites and facility plants with respect to material handling, equipment location, auxiliary services, capital requirements, safety, and personnel organization. \textit{(On demand)}

\textbf{CMET 6285. Quality Assurance in Construction.} (3) Prerequisite: CMET 6160 or consent of instructor. 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 the construction industry. \textit{(Spring)}

\textbf{CMET 6290. Temporary Structures in Construction.} (3) Prerequisite: ETCE 3163 or consent of instructor. Study of temporary structures used to support construction operations such as concrete formwork, scaffolding systems, shoring systems, cofferdams, underpining, slurry walls, and construction dewatering systems. \textit{(On demand)}

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\textbf{CMET 6800. Independent Study in Construction & Facility Management.} (3) Prerequisite: Consent of graduate committee advisor. Individual investigation and exposition of results for a directed project in construction and facility management. May be repeated for credit. \textit{(On demand)}

\textbf{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. \textit{(On demand)}

\section*{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.

\begin{enumerate}
\item \textbf{Personnel}
  \begin{enumerate}
  \item Specify requirements for new faculty, part-time teaching, student assistant and/or increased load on present faculty.
  \end{enumerate}

  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.

  \item List by name qualified faculty members interested in teaching the course(s).
  \begin{itemize}
  \item Dr. Anthony L. Brizendine
  \item Dr. David S. Cottrell
  \item Dr. G. Bruce Gehrig
  \end{itemize}
\end{enumerate}
Additionally, the following faculty members may teach in the program pending appointment to the graduate faculty:

- Dr. Rosida Coowar
- Dr. Chung-Suk Cho

Two additional faculty members currently being recruited to start fall 2009.

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 $150,000. It is anticipated that distance delivery of this program will be requested once the program has been initiated and could begin as early as year 2 of operation.

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 are included in Attachment B. Additionally, representative letters from the professional community have been 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 have been consulted during the initiation of the intent to plan / request to establish / and/or curriculum proposal 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

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• Lee College of Engineering Graduate Committee (EGC) – 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 and has been distributed to COE departments and committees for consideration and comment.

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 5240 – SAFETY & RISK MANAGEMENT

Proposed Catalog Description:

CMET 5240. Safety & Risk Management. (3) Prerequisite: CMET 4228 or consent of instructor. Causes and prevention of industrial accidents. Hazardous processes and material. OSHA regulations and requirements. Design of accident prevention programs. (Spring)

Pre- or Co-requisites:

CMET 4228 or consent of instructor.

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 asked to leave the classroom for the remainder of the class period.

Proposed Text:


Or


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 Catalog Description:

**FMET 5270. Operation of Constructed Facilities. (3)** Prerequisite: CMET 3224 and ETCE 3271 or consent of instructor. Acquisition, operation, maintenance, and disposal of building systems, structures, permanent interiors, furniture, and equipment; grounds and other exterior elements. *(Spring)*

**Pre- or Co-requisites:**

CMET 3224 and ETCE 3271 or consent of instructor.

**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:


Or

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
CMET 6000 – SPECIAL TOPICS IN CONSTRUCTION & FACILITY MANAGEMENT

Proposed Catalog Description:

CMET 6000. Special Topics in Construction & Facility Management. (3) Study of specific new areas emerging in the various fields of construction and facility 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 6130 – BUILDING INFORMATION MODELING

Proposed Catalog Description:

CMET 6130. 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](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](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:*

Or


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 6135 – ADVANCED CONSTRUCTION PLANNING & MANAGEMENT

Proposed Catalog Description:

CMET 6135. 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:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Homework</td>
<td>15%</td>
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<tr>
<td>Mid-term Exam</td>
<td>25%</td>
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<tr>
<td>Course Project</td>
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<tr>
<td>Final Exam</td>
<td>25%</td>
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<tr>
<td>Participation</td>
<td>10%</td>
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</tbody>
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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 asked to leave the classroom for the remainder of the class period.

*Proposed textual resources will be drawn from the following:*

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,
And

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 6140 – BUILDING ENERGY MANAGEMENT

Proposed Catalog Description:

CMET 6140. 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:
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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 asked to leave the classroom for the remainder of the class period.

Proposed Text:

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: Maintenence
Week 12: Waste Heat Recovery
Week 13: Thermal Energy Storage
Week 14: Compressed Air System Optimization
Week 15: Renewable Energy
Proposed Catalog Description:

CMET 6145. Facilities Management Financial Analysis. (3) Prerequisite: ETGR 3222 or ECON 2102 or consent of instructor. 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:

ETGR 3222 or ECON 2102 or consent of instructor.

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:**

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
CMET 6155 – PLANT INSTRUMENTATION AND CONTROLS

Proposed Catalog Description:

CMET 6155. Plant Instrumentation and Controls. (3) Prerequisite: ETME 3163 or consent of instructor. 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:

ETME 3163 or consent of instructor.

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 asked to leave the classroom for the remainder of the class period.

Proposed Text:

Or
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
CMET 6160 – RESEARCH AND ANALYTICAL METHODS

Proposed Catalog Description:

CMET 6160. 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](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](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 asked to leave the classroom for the remainder of the class period.

**Proposed Text:**


Or

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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
CMET 6180 - ALTERNATIVE PROJECT DELIVERY METHODS

Proposed Catalog Description:

CMET 6180. Alternative Project Delivery Methods. (3) Prerequisite: CMET 3224 or consent of instructor. 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:

CMET 3224 or consent of instructor.

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:

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<td>Final Exam</td>
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</table>
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 asked to leave the classroom for the remainder of the class period.

Proposed Text:

Or


*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 6250. ASSET MANAGEMENT FOR FACILITY MANAGERS

Proposed Catalog Description:

CMET 6250. Asset Management for Facility Managers. (3) Prerequisite: CMET 5270 or consent of instructor. 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:

CMET 5270 or consent of instructor.

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

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2. Attendance

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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

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Proposed Text:

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
CMET 6255 – ADVANCED PLANT LAYOUT AND DESIGN

Proposed Catalog Description:

CMET 6255. Advanced Plant Layout and Design. (3) Prerequisite: CMET 5270 or consent of instructor. 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:

CMET 5270 or consent of instructor.

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:

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Specific Course Policies:
The following policies apply to students in this course:

1. **Academic Integrity**

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2. **Attendance**

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- A = 90-100%
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4. **Homework and Assignments**

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*Proposed Text:*


*And*
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
CMET 6285 – QUALITY ASSURANCE IN CONSTRUCTION

Proposed Catalog Description:

CMET 6285. Quality Assurance in Construction. (3) Prerequisite: CMET 6160 or consent of instructor. 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:

CMET 6160 or consent of instructor.

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 plan.
- 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:

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Specific Course Policies:
The following policies apply to students in this course:

1. **Academic Integrity**

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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:*

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
CMET 6290 – TEMPORARY STRUCTURES IN CONSTRUCTION

Proposed Catalog Description:

CMET 6290. Temporary Structures in Construction. (3) Prerequisite: ETCE 3163 or CEGR 3122 or consent of instructor. 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:

ETCE 3163 or consent of instructor.

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

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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

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Proposed Text:


Or

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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) Prerequisite: CMET 5135. 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:

Prerequisite: CMET 6135.

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](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](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 asked to leave the classroom for the remainder of the class period.

*Proposed textual resources will be drawn from the following:*

And

And

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 & FACILITY MANAGEMENT

Proposed Catalog Description:

CMET 6800. Independent Study in Construction & Facility Management. (3) Prerequisite: Consent of graduate committee advisor. Individual investigation and exposition of results for a directed project in construction and 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 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
Attachment B: Consultation Documentation

Internal Consultation Letters:

- Alison Bradley – UNC Charlotte Library
- Robin Cogar – Interim Chair, Dept. of Mechanical Engineering & Engineering Science, UNC Charlotte
- Yogi Kakad - Interim Chair, Dept. of Electrical & Computer Engineering, UNC Charlotte

Representative External Industry Consultation Letters:

- Jeffrey Gagne, STV/Ralph Whitehead Associates, Inc.
- Tim Garrison, President, RT Dooley Construction Company
- Timothy Stevens, Vice-President, The Whiting-Turner Contracting Company
- Michael Phillips, Manager of Construction Operations, AREVA NP, Inc.
- Edward Maher, Project Manager, LEEP AP, Turner Construction Company
- Thomas Beggs, Director of Facilities, Providence Day School
- Gary Bradley, Senior Forensic Consultant, PTC Forensic Consulting Services
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
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
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September 19, 2008

Dear Tony:

This letter is to offer support for the Masters of Science in Construction and Facilities Management recently proposed by your department. The course and curriculum proposed was clearly well thought through to fulfill a unique niche within the College, and thus help fulfill an educational need for related industry.

On behalf of the Department of Mechanical Engineering and Engineering Science I offer my endorsement to this Masters of Science Degree proposal.

Robin N. Coger, Ph.D.
Interim Chair, Department of Mechanical Engineering and Engineering Science
To: Dr. Tony Brizendine, Chair  
Engineering Technology Department  

From: Y. P. Kakad, Interim Chairman  
Department of Electrical and Computer Engineering  

Date: September 18, 2008  

Subject: Support Letter for the Proposals ET 9-02-08a & ET 9-02-08b  

On behalf of the Electrical and Computer Engineering I would like to express our strong support for the proposals to establish (a) Master of Science Program in Construction and Facilities Management (MSCFM), (b) Master of Fire Protection and Administration (MFPA). Both the programs are long overdue and provide the department faculty to engage in graduate education as well as provide an opportunity for the practicing engineers to pursue advanced education. The department realizes that the establishment of these programs is consistent with the long term mission of your department and I hope we can work together for the successful implementation of these programs.
Hello Tony,

I am attaching a letter of support for the two proposals. Let me know if you need anything additional. I can also send a hard copy of this if you need.

With best wishes.

Yogi

Fellow COE Department Chairs,

As you know, I am on the CAC schedule to discuss the following curriculum proposals tomorrow morning:

1) Master of Science in Construction & Facilities Management, and
2) Master of Fire Protection & Administration.

I would like to engage each of you to request letters of support for each of these two programs which are now being forwarded through the curriculum process. An email, if you prefer, will be acceptable. The programs, which we have discussed at CAC previously at the intent to plan and request to establish stages, are fairly straightforward. Both programs have gone through the Intent to Plan process early in 2008. Requests to Establish were developed in April 2008. Curricula have been developed for each program this summer. I am attaching an electronic copy of the curriculum proposals for your convenience and will answer any questions you may have at CAC tomorrow morning.

I will entertain any questions or concerns you may have regarding the proposals. Thank you for your consideration.

best regards,
Tony

p.s. I will bring copies of the attachments tomorrow for your convenience.
April 23, 2008

Anthony L. Brizendine, PhD, PE
Chair & Professor, Department of Engineering Technology
University of North Carolina at Charlotte
9201 University City Blvd
Charlotte, NC 28223-0001

SUBJECT: MASTERS of SCIENCE
IN CONSTRUCTION & FACILITIES MANAGEMENT

Dear Dr. Brizendine:

As Chairman of the Civil & Construction Board of Industry Advisors for the Department of Engineering Technology, I am writing this letter of support for the proposed Masters of Science in Construction & Facilities Management program at UNC Charlotte. The Engineering Technology Department has taken the Advisory’s Board input seriously and has addressed the needs of the construction industry in and around Charlotte in developing this proposed program. The Board is pleased that this initiative is moving forward.

The proposed program will benefit greatly from the existing BSET program in Construction Management. Courses, laboratories and facilities currently utilized in the Civil ET program can be shared and provide an excellent base for the proposed Masters of Science in Construction & Facilities Management program. Additionally, the existing Civil ET faculty provides a strong core from which to build the program; they are an outstanding group with excellent credentials and significant construction and project management experience. The practical experience of the existing faculty, overall strength of the engineering technology programs, and philosophy of applied engineering in the Department provides the ideal formula for success of the proposed construction management program.

The construction industries of Charlotte and the surrounding areas have needed this program for some time, and we look forward with anticipation to the initiation of the program.

Sincerely yours,

Jeffrey L. Gagné, PE, DBIA
Chairman - UNC Charlotte Civil & Construction Technology Advisory Board
Vice President - STV/Ralph Whitehead Associates, Inc.
April 23, 2008

Mr. Anthony L. Brizendine, PHD, PE  
Chair & Professor, Department of Engineering Technology  
University of North Carolina at Charlotte  
9201 University City Blvd.  
Charlotte, NC  28223-001

Dear Dr. Brizendine:

On behalf of RT Dooley Construction Company, I offer an endorsement for the proposed Master of Science in Construction and Facilities Management (MSCFM) at UNCC.

We are proud of our partnership with UNCC, which provides opportunities for undergraduates to experience practical field and office experience during summer and after school hours. These internships provide an environment for the students to apply what they are learning in their studies to real world situations and more adequately prepares them for employment after graduating.

The curriculum suggested for the MSCFM program will provide for studies in specific areas which will open even greater opportunities for students choosing to participate.

Building Information Modeling, Building Energy Management studies and other courses suggested in the curricula will provide MSCFM graduates with valuable education that will enable them to compete at higher levels within our industry. Green building requirements (LEED), the ever growing complexity of Building Management Systems and many other technological advancements in our industry have increased dramatically in the past few years, making the MSCFM program not only appropriate, but quite timely.

We offer our best wishes for the program, and our continued support of your endeavors.

Sincerely,

RT DOOLEY CONSTRUCTION COMPANY

Tim Garrison  
President
April 24, 2008

Dr. Anthony L. Brizendine
Chair and Professor
Engineering Technology/Construction Management
UNC Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001

Re: Master of Science in Construction & Facilities Management

Dear Dr. Brizendine,

I write this letter in support of your proposal to implement a Master of Science in Construction & Facilities Management program.

As Vice President of Whiting-Turner Contracting Company, I am very cognizant of the need for qualified graduates in these disciplines. As a member of your Construction Management Advisory Board and having presented to your Construction Professional Development Seminar during each of the past two years at UNC Charlotte, I am also extremely aware of the quality programming in your BS Construction Management program. Extension of this program to the MS in Construction & Facilities Management is a logical step to produce advanced technical workers for the North Carolina construction and business communities.

I look forward to continuing the working relationship between Whiting Turner Contracting Company and your Department to establish this program and provide internship and career opportunities for graduates of the program.

Very truly yours,

THE WHITING-TURNER CONTRACTING COMPANY

[Signature]
Timothy L. Stevens
Vice President
April 23, 2008

Anthony L. Brizendine, PhD, PE
Chair & Professor, Department of Engineering Technology
University of North Carolina at Charlotte
9201 University City Blvd.
Charlotte, NC 28223-0001

Dear Dr. Brizendine:

As a member of the Civil Engineering Technology and Construction Management Industry Advisory Board representing AREVA NP, it is my pleasure to provide this letter of support for the proposed Master of Science program in Construction & Facilities Management at the University of North Carolina, Charlotte (UNCC). AREVA NP has been a strong supporter of the Engineering Technology program for many years and has benefited from the employment UNCC graduate engineers in our nuclear engineering, services, and construction operations.

The need for such a program is quite apparent, not only for AREVA, but other engineering and construction companies in this area. Charlotte has become the hub for engineering and construction companies poised to deploy the next generation of nuclear power generation plants in the United States. The proposed program will provide the type of construction leadership necessary to build these plants, and facilities manager’s necessary to maintain them once in operation.

AREVA NP thanks you for your progressive planning to prepare future construction professionals for North Carolina and our nation.

Sincerely yours,

Michael K. Phillips
Manager, Construction Management
AREVA NP, Inc.
April 21, 2008

Anthony L. Brizendine, PhD, PE  
Chair & Professor, Department of Engineering Technology  
University of North Carolina at Charlotte  
9201 University City Blvd  
Charlotte, NC 28223-0001

Re: Master of Science in Construction and Facilities Management

Dear Mr. Brizendine,

Thank you for the opportunity to review your proposal to implement a Master of Science in Construction and Facilities Management. I can say with confidence that this is a worthy program to be offered at the University of North Carolina at Charlotte.

The education I received as a graduate of the Master of Civil Engineering / Construction Management Program from the New Jersey Institute of Technology has helped progress my career in a direction that I do not believe would have been available to me had I not pursued the degree. As a result, I believe that implementation of the proposed program at the University of North Carolina at Charlotte would be beneficial not only to the individual students but to the industry as a whole. I am confident that graduates of this program would enter the industry with a professional advantage not possessed by other job candidates.

Currently, the Carolinas Business Unit of Turner Construction Company employs six University of North Carolina at Charlotte graduates. It is our hope to continue to grow our business unit with the hiring of graduates of the Master of Construction and Facilities Management Program. In addition, Turner would like to offer our continued support with guest speakers.

I applaud your efforts to implement this program and look forward to supporting the program in any way that I can.

Sincerely,

Edward Maher
Project Manager, LEED AP
Turner Construction Company
Carolinas Region
April 18, 2008

Anthony L. Brizendine, PhD, PE
Chair & Professor, Department of Engineering Technology
University of North Carolina at Charlotte
9201 University City Blvd
Charlotte, NC 28223-0001

Re: Need for Facilities Management Graduates

Dr. Brizendine,

As a facilities management professional with more than 25 years of experience in construction and facilities engineering, I am keenly aware of the need for qualified graduates having specialized knowledge in these fields.

Over the past several months I have been reviewing resumes of individuals who have applied for the position of Assistant Director of Facilities at Providence Day School. I have been disappointed in the qualifications of these applicants. Most of the applicants fall into two broad categories; those with backgrounds as mechanical or construction technicians but lacking academic credentials, and those with college degrees but lacking specific facilities management experience.

I would be very interested in having a graduate-level program in Charlotte that would provide the necessary training and focus to produce qualified facilities management personnel. I am convinced that there is a very real and pressing need for these graduates, and I applaud your efforts to bring such a program to UNCC.

Please contact me if you have any graduates that you believe may fit our needs.

Sincerely,

Thomas F. Beggs, P.E.
Director of Facilities
Providence Day School
April 23, 2008

Dr. Anthony L. Brizendine, PhD, PE  
Chair & Professor, Department of Engineering Technology  
University of North Carolina at Charlotte  
9201 University City Blvd.  
Charlotte, NC 28223-0001

Subject: Master of Science in Construction & Facilities Management Proposal  
Request to Establish MS Program for acceptance of Engineering Technology  
Department of Engineering Technology  
University of North Carolina at Charlotte

Dear Dr. Brizendine:

This letter is being issued to your attention for submittal to the UNC System General Administration showing my support for the subject MS program in the Department of Engineering Technology at UNC-Charlotte. There is such a need for this type program in the Department of Engineering Technology at UNC-Charlotte that will produce graduates who will contribute to the North Carolina construction and facilities management industries. Having worked first hand, and trained, in the Cost Engineering Division of Project Time & Cost, Inc., I have seen first hand the need for Engineering Technology Graduates to further their education beyond the bachelor level to meet our client and industry needs. The availability of the subject MS program in the Department of Engineering Technology at UNC-Charlotte will support this effort.

I graduated in 1980 from UNC-Charlotte in the Department of Engineering Technology with a Bachelor of Engineering Technology Degree of Civil Engineering.

Sincerely,

Gary B. Bradley, PE, CIT  
Senior Forensic Consultant