BOARD OF HIGHER EDUCATION

REQUEST FOR COMMITTEE AND BOARD ACTION

COMMITTEE: Academic Affairs **NO**.: AAC 11-17

COMMITTEE DATE: March 15, 2011

BOARD DATE: March 22, 2011

APPLICATION OF WESTERN NEW ENGLAND COLLEGE TO OFFER THE DOCTOR OF PHILOSOPHY IN ENGINEERING MANAGEMENT

MOVED: The Board hereby approves the application of **Western New England College** to award the **Doctor of Philosophy in Engineering Management**.

Authority: Massachusetts General Laws Chapter 69 Section 30 et seq.

Contact: Dr. Francesca Purcell, Associate Commissioner for Academic and P-16 Policy

BOARD OF HIGHER EDUCATION

March 2011

Western New England College

Doctor of Philosophy in Engineering Management

INTENT

Western New England College (WNEC) filed a petition with the Department of Higher Education to seek approval to award the Doctor of Philosophy in Engineering Management degree. Engineering Management is the application of engineering principles to the planning and operational management of industrial and manufacturing operations. Specifically, it involves the coordination, design, and optimization of systems using people, materials, information, equipment, energy, and capital. Recently, the field has expanded to include service and transportation systems.

The proposed program seeks to prepare graduates to be successful educators, researchers, and practitioners in the management of engineering and technology in areas related to the improvement, design, and management of projects and programs within complex human-technological systems. These systems include engineering systems, health care systems, service systems and logistical/transportation systems. Graduates of the program will be prepared to assume a faculty position at a college or university and/or may seek advancement in their current careers. WNEC currently offers a Master of Science in Engineering Management among other engineering graduate and undergraduate degrees.

INSTITUTIONAL OVERVIEW

Western New England College is a non-profit institution, located in Springfield, Massachusetts and accredited by the New England Association and Schools and Colleges. The College was chartered in 1951 and authorized to offer the Bachelor of Business Administration "with specification in the fields of Accounting, Management and Engineering and Business and the degree of Bachelor of Laws, together with honorary degrees usually conferred." In May 1956, the College was approved to offer the Bachelor of Science with specification in the fields of Industrial Engineering and Mechanical Engineering, as well as the Master of Business Administration. In May 1959, the Board of Higher Education approved the College to grant "degrees such as are usually conferred in the Commonwealth of Massachusetts in the field of Business Administration, Science, Engineering, Education and Law, except at the doctorate level, together with honorary degrees such as usually conferred by colleges in the Commonwealth of Massachusetts."

In February 1968, Western New England College was authorized to amend its purpose "to conduct a college for the teaching of subjects in the Arts and Sciences, in Business, Technical and Scientific Curricula, and in Law with authority to grant and confer degrees such as are usually conferred in the Commonwealth of Massachusetts, except at the doctorate level." In April 1970, the Board of Higher Education approved the petition of the College "to conduct a college for the teaching of subjects in the Arts and Sciences, in Business, Technical, and Scientific Curricula, and in Law; with the authority to grant and confer degrees such as are usually conferred in the Commonwealth of Massachusetts, except at the doctorate level, but including the first professional degree in Law." The Massachusetts Board of Higher Education approved Western New England College to award the LL.M. in Estate Planning and Elder Law in February 2007; the Doctor of Philosophy in Behavior Analysis in January 2008; and the Doctor of Pharmacy in December 2009. Western New England College currently has schools of Arts and Sciences, Business, Engineering, Law, and Pharmacy.

ACADEMIC AND RELATED MATTERS
Curriculum (Attachment A)

The coursework focus areas will include: 1. industrial and resource management; 2. engineering economy; 3. mathematical modeling; 4. operations research; and 5. quality engineering. All students must complete the following four core courses: Forecasting and Demand Modeling; Engineering Supply Chain; Optimization Methods; and Seminar / Research Methods for Engineering Management. Two graduate program curriculum outlines are provided in the appendices. Most students will enter the program with a master's degree in engineering management, or a closely related field. A student who enters the program without a master's degree in engineering management, or a closely related field, will need to complete three additional "leveling" courses and three elective courses. All students must complete a minimum of 24 credits toward the dissertation

In addition to coursework, each student must complete a preliminary examination, a comprehensive examination, a proposal defense and a dissertation defense to obtain the degree. Before completing four terms at WNEC, a student must pass the preliminary examination administered by the department. A student may attempt the examination no more than twice. Before completing five terms at WNEC, a student must select a major advisor and an advisory committee. With the assistance of the advisor, the student will prepare a plan of study that must be approved by the advisory committee, department chair, and dean before the comprehensive examination is attempted. Advisory committees will consist of at least three departmental members and at least one member from outside the department. Students must then pass the comprehensive examination covering the major area of study. A student may attempt this examination no more than twice. This examination will be administered by the student's advisory committee and is intended to ensure that the student is prepared for dissertation research efforts. A student may enroll in dissertation hours only after passing the core course requirements.

Graduates of the program will demonstrate the following skills and knowledge areas:

A. A solid foundation and depth in engineering management theory and practice
   Students will demonstrate an understanding of the fundamentals of the management of complex human-technological systems and the modeling and analysis of such systems.

B. Breadth across multiple types of human technological systems
   Students will gain expertise through case studies and examples with applications in the following three areas: a. engineering and manufacturing systems; b. service systems; c. logistical systems.

C. Contribute to the body of knowledge in engineering management
   Students will successfully complete the doctoral dissertation.

Table I below diagrams the relationship between the course contributions to each of these three overarching principles:

	Contributing Course[1]	Specific Contribution
Principle 1	EMGT 605 Engineering Management	Fundamental Engineering Management Topics
	EMGT 607 Quality Engineering	Six Sigma Quality
	EMGT 609 Engineering Cost Analysis	Accounting, Finance and Taxation of Engineering Projects
	EMGT 615 Statistical Quality Control	Statistical Inference, Control Charts and Process Capability Studies
	EMGT 648 Project Management	Coordination and Control of Projects
	EMGT 702 Systems Engineering	Life Cycle Modeling and Phases
	EMGT 706 Enterprise and Complex Systems for Engineers	Lean Process Modeling
	EMGT 707 Forecasting and Demand Modeling	Evaluating and Predicting Customer Demand
	EMGT 726 Advanced Modeling and Analysis of Systems	Information System Use and Modeling
	EMGT 731 Probability Theory and Stochastic Applications	Evaluation of Probabilistic Systems
	EMGT 735 Optimization Methods I	Revised Simplex Methods for Solving Linear Programs
	EMGT 736 Optimization Methods II	Modeling Systems Using Dynamic Programming
	EMGT 751 Scheduling and Sequencing	Combinatorial Issues Associated with Sequencing
Principle 2A	EMGT 619 Engineering Supply Chain	Management and Decision Making in the Engineering Supply Chain
	EMGT 609 Engineering Cost Analysis	Cost Estimation of Manufacturing Components and Engineering Tools / Design
	EMGT 615 Statistical Quality Control	Process Control and Monitoring of Manufacturing Systems
	EMGT 643 Design of Experiments	Identifying Statistically Significant Factors for Engineering Design and Manufacturing
	EMGT 644 Quality Systems and Progress Improvement	Maintaining Product Quality while Instituting Continuous Improvement
	EMGT 648 Project Management	Management of Projects involving Capital, Equipment, People, and Information.
	EMGT 709 Advanced Engineering Cost Estimation	Activity Based Costing of Manufacturing Operations
	EMGT 726 Advanced Modeling and Analysis of Systems	Modeling and Improvement of Manufacturing Operations
	EMGT 732 Reliability and Maintainability	Comparison of Preventive Maintenance Schemes
	EMGT 735 Optimization Methods I	Minimizing Production Time based on Machine Set-Up
	EMGT 751 Scheduling and Sequencing	Product Sequencing to Minimize Make-span
Principle 2B	EMGT 609 Engineering Cost Analysis	Cost Justification of Energy Systems
	EMGT 607 Quality Engineering	Benchmarking and Documentation within Healthcare and Financial Systems
	EMGT 643 Design of Experiments	F-tests to Identify Statistically Significant Factors for Systems Involving Queues (Banks, Hospitals,

[1] A course may contribute to more than a single principle but only 1 listed per course/principle combination

		Amusement Parks, …)
	EMGT 706 Enterprise and Complex Systems for Engineers	Ensuring Delivery of Critical and Non-Critical Material and Equipment for Service Systems
	EMGT 709 Advanced Engineering Cost Estimation	Learning Curve for Prediction of Employee Performance
	EMGT 726 Advanced Modeling and Analysis of Systems	Modeling and Improvement of Healthcare Operations
	EMGT 732 Reliability and Maintainability	Cost Prediction of Highly Reliable Systems and Components
	EMGT 736 Optimization Methods II	Evaluation and Optimization of Educational Systems using Markov Chains
Principle 2C	EMGT 619 Engineering Supply Chain	Managing Engineering Supply Chain Logistics
	EMGT 644 Quality Systems and Progress Improvement	Improving on-time Delivery of Goods to Maximize Customer Satisfaction
	EMGT 706 Enterprise and Complex Systems for Engineers	Design and Development of ERP Systems
	EMGT 709 Advanced Engineering Cost Estimation	Estimation of the Cost Associated with a Failed Material Delivery
	EMGT 726 Advanced Modeling and Analysis of Systems	Modeling and Improvement of Port Operations
	EMGT 732 Reliability and Maintainability	Cost of Redundant Transportation Systems
	EMGT 735 Optimization Methods I	Minimizing Travel Time Associated with Routing of Aircraft
	EMGT 736 Optimization Methods II	Supplier Selection Based on Multiple Probabilistic Inputs
	EMGT 751 Scheduling and Sequencing	Crew Scheduling of Commercial Aircraft
Principle 3	EMGT 701 Seminar	Research Methods
	EMGT 701 Seminar	Contemporary Research Topics
	EMGT 701 Seminar	Constructing a Literature Review
	EMGT 770-799 Dissertation Research	Specific to Student Topic

There will be several delivery methods employed by this program. These methods are: 1) traditional in-class lectures; 2) mixed in-class lectures and on-line learning modules and; 3) dissertation and research advising. All lectures will be captured and available to review on-line.

Full-time students will be able to complete the program in three to five years and part-time students will be able to complete the program in four to six years. Students who do not successfully complete the Ph.D. program but have met the requirements of the current Master of Science in Engineering Management degree will be awarded that degree upon exit from the program.

Tuition and Fees

Tuition for the 2010-2011 academic year for doctoral programs at WNEC is $1,092 per credit ($3,276 per course).

Admission
The following are the minimum requirements for admission to the Ph.D. in Engineering Management program:

1. Test of English as a Foreign Language (TOEFL)
Students with English as a second language are required to secure a score of 550 or higher in TOEFL, unless they have attended a U.S. university for the equivalent of at least one year.

2. Prerequisites
    a. Possession (or nearing the completion) of a master's degree in engineering, or closely related disciplines (Students will a bachelor's degree may be eligible on a case-by-case basis based upon prior coursework.)
    b. Competence in at least one structured programming language: (i.e. C, C++, FORTRAN, Visual BASIC,…)
    c. Evidence of completion of the following course(s) (C or better)
    Probability and Statistics

3. Cumulative GPA in graduate courses: On a 4.0 scale, must achieve at least a 3.5 in all graduate work.

4. GRE: Minimum 1100 (General) score

Projected Enrollment

The proposed program is designed to graduate three to five students per year, and will be populated by full-time and part-time students. By 2016, the goal of the program is to maintain twenty to twenty five concurrent Ph.D. students. This population will be a combination of full-time and part-time students. Additionally, WNEC anticipates approximately three-fourths of enrolled full-time students to be international students.

The Department of Industrial Engineering currently offers a Master of Science in Engineering Management and it is anticipated from a recent alumni survey that several of these students and graduates will continue their pursuit of graduate study in the proposed Ph.D. program. WNEC also anticipates that international students will compose a significant proportion of the students in the program.

RESOURCES

Human Resources
The proposed program will be administered by the Department of Industrial Engineering within the School of Engineering at Western New England College. The director of the program will be responsible for forming and initially chairing committees responsible for admission, program evaluation, recruiting, and marketing. These duties will require that the program director have a reduced teaching load of six credits per academic year. The director of the program will initially be the Chair of the Industrial Engineering Department. During the fall of 2013 a permanent program director will be named from the faculty of the program.

Currently the Department of Industrial Engineering has six faculty members (including the current Dean and Assistant Dean of Engineering), adequate administrative assistant support, and a full-time (shared with one other department) technical support person. WNEC will hire two additional faculty members who will have a Ph.D. in Engineering Management or a closely related field. The desired areas of expertise, which the existing departmental faculty have identified, are:

1. Quality Engineering / Quality Systems
2. Enterprise Resource Planning
3. Service Systems (in particular Health Care and/or Financial Engineering)

Library and Information Technology

The current resources of available journals/texts provided by D'Amour Library are adequate to support the program. The Department of Industrial Engineering in conjunction with the Office of Information Technology at Western New England College currently maintains site licenses of the following applicable software environments:

SAP (enterprise resource planning). Western New England College is a SAP academic partner institution.
Flexsim, Flexsim CT, and Flexsim HC (general, transportation and healthcare simulation). We current maintain 25 full industrial versions of this discrete event simulation software.
ARENA (general simulation). We currently maintain 22 industrial sized versions of this discrete event simulation software.
MySQL server (database). We currently maintain an off-campus server to provide database / information system support (500 users / 500 databases).
LINGO (linear, non-linear, goal, and stochastic programming). We currently maintain 15 industrial-sized versions of this software.
MINITAB (statistical analysis). We currently maintain more than 25 industrial-sized versions of this statistical analysis and quality engineering software.
DELMIA PLM (manufacturing and design). We currently maintain 10 industrial-sized versions of their PLM product.
ENVOIA (collaborative engineering design). We currently maintain 10 industrial-sized versions of this collaborative design package.

Physical Resources
The program will be housed in newly renovated space in Sleith Hall. In addition to classroom and office space, a computer lab will be devoted to the students of the program.

Financial Resources (Attachment B)
A multi-year budget projection has been developed for the proposed program.

EVALUATION

Visiting Committee
The proposed program was evaluated by an external visiting committee composed of Dr. David Koonce, Department of Industrial and Systems Engineering, Ohio University; Dr. James Swain, Department of Industrial and System Engineering, University of Alabama-Huntsville; and Dr. Donald Merino, Humphreys Professor of Economics and Engineering, Stevens Institute of Technology. The committee reviewed the petition and appendices in preparation for the site visit, which took place September 12-14, 2010. During the visit, the committee met with administrators, faculty, staff, and students; and toured the campus. the criteria that guided the review were the standards currently utilized by the New England Association of Schools and

Colleges, supplemented by the criteria of the Independent Institutions of Higher Education Standards, 610 C.M.R. 2.08 (3) (b) through (g).

Overall, the committee found that the proposal to add the Ph.D. in Engineering Management aligned well with the mission of Western New England College and its school of engineering and that the program had good integrity. The committee found strength in the proposed administration and governance of the program and noted that WNEC was a strong institution financially and able to support and sustain the proposed program. The committee found that the faculty are qualified and enthusiastic and that the proposed program has support throughout the College and adequate physical resources.

The committee identified a few weaknesses with respect to the degree requirements and the expectations for doctoral research; faculty experience in directing doctoral research; and doctoral student funding. The committee specifically recommended that the program require a higher than 3.0 GPA and a minimum GRE score for its admissions standards; add project management, management theory, organizational behavior and organizational psychology into the curriculum; develop a research culture for master's students who will be entering into the doctoral program; develop funding for recruiting and employing full-time Ph.D. students; and plan more fully for faculty serving on and directing doctoral committees.

Institutional Response

In response to the committee's recommendations, WNEC raised the required GPA for incoming students to a 3.5 and set a minimum required GRE score of 1100. Project management was added as a required course for all students and courses covering management theory and organizational behavior have been added to the curriculum. To further develop and instill a research-based culture, WNEC committed to encouraging more master's students to pursue thesis and project work; incorporating a research project component in most doctoral level courses; involving students with faculty research and funding proposals; and initiating a seminar series focusing on contemporary research in the field. Upon admission of students, WNEC has committed to provide four graduate teaching fellows to the Industrial Engineering and Engineering Management (IEEM) Department to support engineering management doctoral students who will receive tuition waivers and receive a stipend of $12,000 per year. WNEC will hire a new full-time faculty member at a senior level with experience in directing doctorate level research to assist with mentoring current faculty members in directing Ph.D. students.

PUBLIC HEARING

The required public hearing was held in the Board of Higher Education office on January 18, 2011. No comments were offered in opposition to the proposed program.

STAFF ANALYSIS AND RECOMMENDATION

After a thorough evaluation of all documentation submitted, staff is satisfied that the proposed Doctor of Pharmacy at Western New England College meets the criteria set forth in 610 CMR 2.08 (3) in the Degree-Granting Regulations for Independent Institutions of Higher Education, accredited by the New England Association of Schools and Colleges. Recommendation is for approval.

Attachment A

Graduate Program Curriculum Outline (Students with M.S. EMGT)

Major Required (Core) Courses (Total # of courses required = 5+Dissertation Courses equaling minimum of 24 credit hours)		
Course Number	**Course Title**	**Credit Hours**
EMGT 619	Engineering Supply Chain	3
EMGT 648	Project Management	3
EMGT 707	Forecasting and Demand Modeling	**3**
EMGT 735	Optimization Methods I	**3**
EMGT 701	Seminar/Research Methods for Engineering Management	**3**
EMGT 770-799	Dissertation	24 minimum
	SubTotal # Core Credits Required	39
Elective Course Choices (Total courses required = 6) *(attach list of choices if needed)*		
MAN 600	Team Leadership	3
BUS 600	Changing Business Environment	3
EMGT 605	Engineering Management	3
EMGT 607	Quality Engineering	3
EMGT 609	Engineering Cost Analysis	3
EMGT 615	Statistical Quality Control	3
EMGT 620	Multi-Criteria Decision Analysis	3
EMGT 622	Lean Production Systems	3
EMGT 626	Discrete Event Systems Simulation	3
EMGT 643	Design of Experiments	3
EMGT 644	Quality Systems and Process Improvement	3
EMGT 702†	Systems Engineering	**3**
EMGT 706†	Enterprise and Complex Systems for Engineers	**3**
EMGT 709†	Advanced Engineering Cost Estimation	**3**
EMGT 726†	Advance Modeling and Analysis of Systems	**3**
EMGT 731†	Probability Theory and Stochastic Applications	**3**
EMGT 732†	Reliability and Maintainability	**3**
EMGT 736†	Optimization Methods II	**3**
EMGT 751†	Scheduling and Sequencing	**3**
	SubTotal # Elective Credits Required	18

Curriculum Summary	
Total number of courses required for the degree	11††
Total credit hours required for degree	57

Prerequisite, Concentration, Dissertation or Other Requirements: *Above are beyond M.S. degree. Students must take a minimum of 24 credit hours of any combination of EMGT 770-799 (Dissertation) and submission of Dissertation required. Additional examinations include Preliminary Examination, Comprehensive Examination (covering major area of study), Dissertation Approval Examination (oral examination on dissertation research proposal), and Dissertation Defense (oral).*

† *From the 18 elective credits required, students must take at least three of these courses.*

†† Excludes number of Dissertation courses needed to meet 24 credit hour minimum requirement.

Graduate Program Curriculum Outline (Students with M.S. not EMGT)

Major Required (Core) Courses (Total # of courses required = 7+Dissertation Courses equaling minimum of 24 credit hours)		
Course Number	**Course Title**	**Credit Hours**
EMGT 619	Engineering Supply Chain	3
EMGT 648	Project Management	3
EMGT 707	Forecasting and Demand Modeling	3
EMGT 735	Optimization Methods I	3
EMGT 701	Seminar/Research Methods for Engineering Management	3
EMGT 770-799	Dissertation	**24 minimum**
EMGT 643	Design of Experiments	3
EMGT 644	Quality Systems and Process Improvement	3
	SubTotal # Core Credits Required	45
Elective Course Choices (Total courses required = 4) *(attach list of choices if needed)*		
MAN 600	Team Leadership	3
BUS 600	Changing Business Environment	3
EMGT 607	Quality Engineering	3
EMGT 609	Engineering Cost Analysis	3
EMGT 615	Statistical Quality Control	3
EMGT 620	Multi-Criteria Decision Analysis	3
EMGT 622	Lean Production Systems	3
EMGT 626	Discrete Event Systems Simulation	3
EMGT 702†	Systems Engineering	**3**
EMGT 706†	Enterprise and Complex Systems for Engineers	**3**
EMGT 709†	Advanced Engineering Cost Estimation	**3**
EMGT 726†	Advance Modeling and Analysis of Systems	**3**
EMGT 731†	Probability Theory and Stochastic Applications	**3**
EMGT 732†	Reliability and Maintainability	**3**
EMGT 736†	Optimization Methods II	**3**
EMGT 751†	Scheduling and Sequencing	**3**
	SubTotal # Elective Credits Required	9

Curriculum Summary	
Total number of courses required for the degree	11††
Total credit hours required for degree	57

Prerequisite, Concentration, Dissertation or Other Requirements: *Above are beyond M.S. degree. Students must take a minimum of 24 credit hours of any combination of EMGT 770-799 (Dissertation) and submission of Dissertation required. Additional examinations include Preliminary Examination, Comprehensive Examination (covering major area of study), Dissertation Approval Examination (oral examination on dissertation research proposal), and Dissertation Defense (oral).*

† *From the 12 elective credits required, students must take at least four of these courses.*

†† Excludes number of Dissertation courses needed to meet 24 credit hour minimum requirement.

Attachment B: Budget

Academic Year

Costs	**2011-2012**	**2012-2013**	**2013-2014**	**2014-2015**	**2015-1016**	**2016-2017**	**2017-beyond**
Full Time Faculty Salary	$80,000.00	$160,000.00	$160,000.00	$160,000.00	$160,000.00	$160,000.00	$160,000.00
Overhead/Indirect (40% of Salary)	$32,000.00	$64,000.00	$64,000.00	$64,000.00	$64,000.00	$64,000.00	$64,000.00
Faculty Travel and Support	$1,250.00	$2,500.00	$2,500.00	$2,500.00	$2,500.00	$2,500.00	$2,500.00
Misc Operating Expenses		$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00
Faculty Start-Up (computers, furniture, software, …)	$5,000.00	$5,000.00					
Adjunct Faculty Salary			$4,000.00	$8,000.00	$12,000.00	$12,000.00	$12,000.00
On-Line Teaching Equipment, Software, Maintenance		$15,000.00	$15,000.00	$15,000.00	$15,000.00	$15,000.00	$15,000.00
8 Computer Workstations / Printer / Maintenance		$18,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00	$2,000.00
Graduate Teaching Fellow Stipends		$48,000.00	$48,000.00	$48,000.00	$48,000.00	$48,000.00	$48,000.00
Total Costs	*($118,250.00)*	*($317,500.00)*	*($300,500.00)*	*($304,500.00)*	*($308,500.00)*	*($308,500.00)*	*($308,500.00)*
Projected Enrollment	**2011-2012**	**2012-2013**	**2013-2014**	**2014-2015**	**2015-Beyond**	**2016-2017**	**2017-Beyond**
Full Time	0	2	5	7	8	9	9
Part Time	0	10	16	18	16	13	12
Total Enrollment	*0*	*12*	*21*	*25*	*24*	*22*	*21*
Revenues ($925/credit hour)	**2011-2012**	**2012-2013**	**2013-2014**	**2014-2015**	**2015-Beyond**	**2016-2107**	**2017-Beyond**
Tuition (Full Time Student = 24credits/yr)	$ -	$44,400.00	$111,000.00	$155,400.00	$177,600.00	$199,800.00	$199,800.00
Tuition (Part Time Students = 12 credits/yr)	$ -	$111,000.00	$177,600.00	$199,800.00	$177,600.00	$144,300.00	$133,200.00
Total Revenue		*$155,400.00*	*$288,600.00*	*$355,200.00*	*$355,200.00*	*$344,100.00*	*$333,000.00*
Total	**($118,250.00)**	**($162,100.00)**	**($11,900.00)**	**$50,700.00**	**$46,700.00**	**$35,600.00**	**$24,500.00**