



9-8-2016

Curriculum Committee Report - September 8, 2016

Graduate Council

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**Graduate Curriculum Committee Meeting Report
405 Student Services Building
Thursday, September 8, 2016**

Members present: Robert Fuller (Chair), David Bemis, Stergios Botzakis, Kivanc Ekici, Rebecca Jackson, Sibyl Marshall, Stefanie Ohnesorg

Also in attendance: Mary Albrecht (Accreditation), Jeffrey Fairbrother (College of Education, Health, and Human Sciences), Marian Roman (Chair, Graduate Council), Dixie Thompson (Dean of the Graduate School), Russell Zaretzki (for Bredesen Center for Interdisciplinary Research and Graduate Education), Catherine Cox

Robert Fuller called the meeting to order at 3:45 p.m. Robert welcomed the new members.

Curriculum proposals for discussion:

- 1) Haslam College of Business
 - a) Course changes: added 1 course, revised 4 courses, dropped last course and academic discipline for IOP.
 - b) Program changes: revised *MBA Programs for Working Professionals*.

- 2) College of Nursing
 - a) Program changes: revised *Nursing major, MSN (Nursing Administration concentration)*.
The Curriculum Committee had questions concerning the change in program hour requirements from 12 to 21. It was noted that 9 hours of elective courses were dropped last year and 3 new courses added to replace the electives. However, the revision to the program requirements was not submitted in last year's proposals.
 - b) **Informational Item:** The Curriculum Committee recognized the above error, and with confirmation from Dr. Gunther as to the error, **the Committee voted and approved an adjustment to the current 2016-17 Graduate Catalog to revise the hours from 12 to 21 in order for the catalog to accurately display the requirements.**
 - i) Email sent to Dr. Gunther (cc: Marian Roman and Robert Fuller). Dr. Gunther confirmed this was an oversight and approved of the immediate change to the catalog.

- 3) Bredesen Center for Interdisciplinary Research and Graduate Education
 - a) Course changes: added new academic discipline – Data Science and Engineering (DSE) and 10 courses. This is in alignment with the new DSE doctoral major being added.
 - b) Program changes: added new major and degree – *Data Science and Engineering, PhD*
 - c) **Informational Item:** It was noted there was some redundant wording under the Doctoral Committee Heading concerning submitting the Admission to Candidacy Application. **After discussion, it was voted and approved to end the sentence after the word "form."**

All items were approved as indicated above and are recommended to Graduate Council for approval.

The meeting was adjourned at 5:05.

Respectfully submitted,

Catherine Cox
Graduate Curriculum Coordinator

Thursday September 8, 2016 3:45 P.M.	Graduate Curriculum Committee Meeting	405 Student Services Building
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AGENDA

Haslam College of Business

College of Nursing

**Intercollegiate: Bredesen Center for Interdisciplinary Research and
Graduate Education**

+ Indicates add of new Major

HASLAM COLLEGE OF BUSINESS

All Changes Effective Fall 2017

I. COURSE CHANGES

Learning Goals and Objectives for the Full-time MBA Program:

Application of Business Knowledge and Skills: Apply functional knowledge and skills developed in the first year MBA curriculum to address critical, real-world business issues

Ethical Decision Making in a Global Context: Identify and effectively evaluate business problems and opportunities in a global market environment.

Presentation Skills Development: Demonstrate the acquisition and utilization of fundamental presentation, data analysis, and communication skills necessary to successfully influence the consideration of new business ideas in an organizational setting.

Collaboration: Perform effectively as a team member.

DEPARTMENT OF FINANCE

(FINC) Finance

REVISE HOURS AND DROP REPEATABILITY

FINC 641 (3) Seminar in Finance

Formerly: (1-3), Repeatability: May be repeated. Maximum 3 hours.

Rationale: All students taking this class receive 3 hours of course credit. The variable hour setting that is currently available only causes administrative problems. Students often "accidentally" sign up for 1 hour and then have to get the instructor to sign a "change" form to get it changed to 3 hours. Staffing Impact: None Financial Impact: None. Impact on Other Academic Units: None. Learning Outcomes Supported: None. Support from assessment activities: None.

FINC 651 Seminar in Corporate Finance (3)

Formerly: (1-3), Repeatability: May be repeated. Maximum 6 hours.

Rationale: All students taking this class receive 3 hours of course credit. The variable hour setting that is currently available only causes administrative problems. Students often "accidentally" sign up for 1 hour and then have to get the instructor to sign a "change" form to get it changed to 3 hours. Staffing Impact: None Financial Impact: None. Impact on Other Academic Units: None. Learning Outcomes Supported: None. Support from assessment activities: None.

FINC 652 Seminar in Asset Pricing and Markets (3)

Formerly: (1-3), Repeatability: May be repeated. Maximum 6 hours.

Rationale: All students taking this class receive 3 hours of course credit. The variable hour setting that is currently available only causes administrative problems. Students often "accidentally" sign up for 1 hour and then have to get the instructor to sign a "change" form to get it changed to 3 hours. Staffing Impact: None Financial Impact: None. Impact on Other Academic Units: None. Learning Outcomes Supported: None. Support from assessment activities: None.

DEPARTMENT OF MANAGEMENT

(MGT) Management

DROP

MGT 530 Effective Negotiating (3)

Rationale: No longer taught; has previously only been taught in the MBA program. Staffing Impact: None Financial Impact: None. Impact on Other Academic Units: None. Learning Outcomes Supported: None. Support from assessment activities: None.

DEPARTMENT OF MARKETING AND SUPPLY CHAIN MANAGEMENT

(MARK) Marketing

ADD

MARK 538 Marketing Insights (3) Provides an advanced experience for students interested in more complex techniques for marketing research and strategic decision-making; it trains students how to identify and apply the appropriate data and tools to back up strategic marketing recommendations.

Rationale: The course has been taught for two years under a MKTG 598 "special topics" designation. This request to assign a permanent course number is being made because the intention is to offer the course on an ongoing basis. Therefore it will no longer be considered a "special topic." Staffing Impact: None Financial Impact: None. Impact on Other Academic Units: None.

Learning Outcomes Supported: For the Full-time MBA Program:

1. Application of Business Knowledge and Skills: Apply functional knowledge and skills developed in the first year MBA curriculum to address critical, real-world business issues.
2. Presentation Skills Development: Demonstrate the acquisition and utilization of fundamental presentation, data analysis, and communication skills necessary to successfully influence the consideration of new business ideas in an organizational setting.
3. Collaboration: Perform effectively as a team member. This course aligns with Haslam College of Business value of impact. By providing students with the opportunity to translate data into actionable insights to support strategy, it directly prepares them for managerial positions and provides skills that should be applicable throughout their careers.
4. Support from assessment Activities: Assessment of program learning outcomes did not result in this course proposal, however this proposal does support other important goals of the Haslam College of Business as indicated above.

REVISE TITLE AND DESCRIPTION

MARK 535 Projects in Marketing Research (3) Students design and execute a quantitative marketing research project under faculty supervision. Will emphasize the use of marketing research techniques to improve organizational decision-making and relies on briefings, cases, laboratories, and tutorials (as needed) to provide students with the foundational knowledge necessary for executing the research project. Field work may be necessary.

Formerly: MARK 535 Product Innovation, Design, and Development (3) Will help students understand and master the entire new product development process, from innovation through design to launch. Emphasis is placed on active and team-based learning, and the development of both analytical and creative abilities.

Rationale: Three marketing courses are required for Haslam MBA students to fulfill the requirements for a concentration in marketing. This revision updates one of the three elective courses currently offered to Haslam MBA students pursuing a marketing concentration. Staffing Impact: The proposed change will not have any impact on staffing. No new faculty or GTAs will be needed. Financial Impact: The proposed change will not have a financial impact on the department or college. The proposed change merely involves the revision of a course currently being offered. Impact on Other Academic Units: None.

Learning Outcomes Supported: For the Full-time MBA Program:

1. Application of Business Knowledge and Skills: Apply functional knowledge and skills developed in the first year MBA curriculum to address critical, real-world business issues.
2. Presentation Skills Development: Demonstrate the acquisition and utilization of fundamental presentation, data analysis, and communication skills necessary to successfully influence the consideration of new business ideas in an organizational setting.
3. Collaboration: Perform effectively as a team member.
4. Support from assessment activities: Assessment of program learning outcomes did not result in this course proposal, however this proposal does support other important goals of the Haslam College of Business.

DEPARTMENT OF MANAGEMENT

(IOP) Industrial and Organizational Psychology

DROP ACADEMIC DISCIPLINE AND LAST COURSE

IOP 600 Doctoral Research and Dissertation (3-15)

Rationale: Course and program no longer supported, last students in program have completed requirements and graduated. The rest of the program courses were dropped 1/31/2013 (Grad Council Minutes, G2057, 1/31/2013). Staffing impact: None Financial Impact: none Impact on other units: None. Learning Outcomes Supported: None. Support from assessment activities: None.

II.PROGRAM CHANGES

BUSINESS ADMINISTRATION MAJOR, MBA

Learning Goals and Objectives for Executive MBA and Professional MBA Programs

Leadership Development: Each student will demonstrate the ability to appraise their own leadership strengths and weaknesses; create a leadership development plan with specific, measurable goals to strengthen their leadership potential, assess their progress toward those goals; and revise their plan, as necessary, to support their continued growth and development as a leader.

Application of Knowledge to a Real Company Project: Each student shall assimilate the knowledge of core business disciplines acquired in the classroom and directly apply this knowledge to their workplace so as to achieve the highest level of cognitive learning.

Decision Making in an Integrated and Global Context: By satisfactorily contributing to a team engaged in a competitive Marketplace simulation, each student shall demonstrate an ability to work cooperatively with others to identify and solve business problems in an integrated and global market environment.

Corporate Social Responsibility and Ethics Awareness: Each student shall demonstrate the ability to identify and analyze issues related to corporate social responsibility (CSR), ethics and organizational culture in an applied and integrated business context.

REVISE DESCRIPTION – PROFESSIONAL MBA

In the 2017-2018 Graduate Catalog, revise to delete current text and replace with the following:

Molly Kinard, Director, Professional MBA Program
Bruce Behn, Academic Director, Professional MBA Program

The Professional MBA Program is provided for fully employed professionals. A minimum of five years of work experience is preferred. The emphasis in this program is to provide grounding in the quantitative and qualitative tools of various business functions and a good basis in strategic thinking. Learning is expanded through applying these tools that are the basis for the analysis of various business functions and strategic thinking. Learning is expanded through applying these tools within the student's own organization through a structured project that continues throughout the program. The Professional MBA is the right choice for individuals who wish to enhance their position within their organization by broadening their business knowledge beyond the functional area in which they are currently employed to prepare them for higher level management positions.

The Professional MBA Program operates over three semesters with a hybrid delivery of in-class and online sessions. Requirements for admission includes a completed application, current resume, two letters of recommendations and written essays. The GMAT/GRE may be waived for applicants with 5 or more years of professional work experience or a previous terminal or master's degree. Any request to waive the GMAT/GRE requirement must be submitted with the application package to be reviewed/approved by the director. Additional information on the Professional MBA program can be found at <http://promba.utk.edu>.

Formerly: Molly Kinard, Interim Director, Professional MBA Program; Michael McIntyre, Academic Director, Professional MBA Program.

The weekend Professional MBA is provided for fully employed professionals within commuting distance of the University of Tennessee, Knoxville and who have a minimum of five years of work experience. The emphasis in this program is to provide a good grounding in the quantitative and qualitative tools of various business functions and a good basis in strategic thinking. Learning is expanded through applying these tools within the student's own organization through a structured project each semester. The Professional MBA is the right choice for individuals who wish to enhance their position within their organization by broadening their business knowledge beyond the functional area in which they are currently employed.

The Professional MBA program is three consecutive semesters completed in sixteen months. Classes meet approximately three Saturdays per month and via live, distance learning classes on periodic Tuesday evenings. The program begins in August with an intensive week of classes; then continues with the weekend format. The final fall semester culminates with a week-long marketplace simulation. The GMAT may be waived for applicants with 10 or more years of professional work experience or a graduate degree. Additional information on the Professional MBA program can be found at <http://promba.utk.edu>.

Rationale: The content, purpose, and organization of courses and activities shape every student's experience. The greater diversity of today's student population requires a more flexible approach to transitional support. This proposal is to create a more flexible description for the faculty to upgrade the quality of education with creating programs that provide students with a combination of essential academic skills, rigorous training and on-the-job experience throughout the duration of the program. A more flexible catalog will support entry and progression routes that meet the needs of different students. Staffing Impact: None. Financial Impact: None. Impact on Other Academic Units: None.

Learning Outcomes: The changes proposed are consistent with the Professional MBA program learning objectives:

1. Leadership Development: Each student will demonstrate the ability to appraise their own leadership strengths and weaknesses; create a leadership development plan with specific, measurable goals to strengthen their leadership potential, assess their progress toward those goals; and revise their plan, as necessary, to support their continued growth and development as a leader.
2. Application of Knowledge to a Real Company Project: Each student shall assimilate the knowledge of core business disciplines acquired in the classroom and directly apply this knowledge to their workplace so as to achieve the highest level of cognitive learning.
3. Decision Making in an Integrated and Global Context: By satisfactorily contributing to a team engaged in a competitive Marketplace simulation, each student shall demonstrate an ability to work cooperatively with others to identify and solve business problems in an integrated and global market environment.
4. Corporate Social Responsibility and Ethics Awareness: Each student shall demonstrate the ability to identify and analyze issues related to corporate social responsibility (CSR), ethics and organizational culture in an applied and integrated business context.

Support from assessment activities: There have been multiple student and alumni focus groups and a consistent outcome is the interest in expanding learning to include optional programs, workshops, and experiential learning opportunities. A more flexible catalog will encourage the program faculty to create and offer a richer experience for our students.

REVISE DESCRIPTION – PHYSICIAN EXECUTIVE MBA

In the 2017-2018 Graduate Catalog, revise to delete current text and replace with the following:

Kate Atchley, Director, Physician Executive MBA Program

The Physician Executive MBA is provided for an international audience of physicians. The students for whom this program is designed have an MD, MBBS, or DO degree with five or more years of work experience. The curriculum objectives are the same as those for the Executive MBA, but in the Physician Executive MBA, many of the functional skills are taught in the context of the health care industry with specialized content related to the health care environment. The Physician Executive MBA is the right choice for physicians who want to have a voice in the health care industry, in their own careers, and are seeking a program that allows them to continue their practice while earning their MBA degree.

The Physician Executive MBA is three consecutive semesters completed in twelve months. The class meets in Knoxville for week-long residence periods in January, April, August and December. Between residence periods, live distance learning classes are held each week, and there are asynchronous internet assignments. Applications are accepted for January entry only. Applications are accepted through the year. Applicants to the Physician Executive MBA are not required to take the GMAT. Additional information on the Physician Executive MBA can be found at www.pemba.utk.edu.

Formerly: The Physician Executive MBA is provided for an international audience of physicians. The students for whom this program is designed have an MD, MBBS, or DO degree with five or more years of work experience. The curriculum objectives are the same as those for the Executive MBA, but in the Physician Executive MBA, many of the functional skills are taught in the context of the health care industry with specialized content related to the health care environment. The Physician Executive MBA is the right choice for physicians who want to have a voice in the health care industry, in their own careers, and are seeking a program that allows them to continue their practice while earning their MBA degree.

The Physician Executive MBA is three consecutive semesters completed in twelve months. The class meets in Knoxville for week-long residence periods in January, April, August and December. Between residence periods, live distance learning classes are held each Saturday morning, and there are asynchronous internet assignments. Applications are accepted for January entry only. Applications are accepted through the year. The final application deadline is November 1. Applicants to the Physician Executive MBA are not required to take the GMAT. Additional information on the Physician Executive MBA can be found at www.pemba.utk.edu.

Rationale: Correct inaccuracies in description. Staffing Impact: None Financial Impact: None. Impact on Other Academic Units: None.

Learning Outcomes: The changes proposed are consistent with the Physician Executive MBA program learning objectives:

1. Leadership Development: Each student will demonstrate the ability to appraise their own leadership strengths and weaknesses; create a leadership development plan with specific, measurable goals to strengthen their leadership potential, assess their progress toward those goals; and revise their plan, as necessary, to support their continued growth and development as a leader.
2. Application of Knowledge to a Real Company Project: Each student shall assimilate the knowledge of core business disciplines acquired in the classroom and directly apply this knowledge to their workplace so as to achieve the highest level of cognitive learning.
3. Decision Making in an Integrated and Global Context: By satisfactorily contributing to a team engaged in a competitive Marketplace simulation, each student shall demonstrate an ability to work cooperatively with others to identify and solve business problems in an integrated and global market environment.
4. Corporate Social Responsibility and Ethics Awareness: Each student shall demonstrate the ability to identify and analyze issues related to corporate social responsibility (CSR), ethics and organizational culture in an applied and integrated business context.

Support from assessment activities: None

REVISE DESCRIPTION – EXECUTIVE MBA

In the 2017-2018 Graduate Catalog, revise to delete current text and replace with the following:

Kate Atchley, Director, Executive MBA – Healthcare Leadership track
Shay Scott, Director, Executive MBA – Global Supply Chain track
Michael McIntyre, Director, Executive MBA – Strategic Leadership track

The Executive MBA is provided for a national and international audience of managers holding middle and upper level positions in organizations that support their attainment of an MBA degree. The students for whom this program is designed usually have ten or more years of work experience and are currently in management positions. Typical students bring a greater knowledge of business fundamentals than is true of other MBA programs. The Executive MBA places considerable emphasis on global business, strategic thinking, and individual leadership skills. In addition to the traditional Executive MBA curriculum, the program also offers specialized areas of focus (e.g., supply chain management, healthcare, and strategic leadership) providing students the opportunity to choose an area relevant to their career goals and current business trends. The program has a heavy emphasis in strategic thinking and leading-edge management concepts. The Executive MBA is the right choice for individuals who are in positions of broad responsibility or who have been designated to fulfill such roles within their organizations in the future.

The Executive MBA is a cohort based, three (consecutive) semester program completed in a period of twelve to sixteen months depending on the student's chosen area of focus. The class meets for residence periods approximately once per quarter starting in January and ending in December. One or more of the residence periods may occur at international locations. Off campus work includes distance learning classes and requires substantial and regular contact with faculty and other participants. The project work in the Executive MBA is a large scale management project running for the duration of the program. Students work with managers in their own organizations to choose a project of significant scale and scope. Each project has a faculty advisor.

Applications are accepted for January entry only. Applications are accepted on a rolling basis, with early application encouraged. Applications received after September 1 will be considered subject to space availability. The GMAT may be waived depending on work experience. Additional information on the Executive MBA can be found at <http://execed.utk.edu/choose-mba.asp>

Formerly:

Kate Atchley, Director, Executive MBA – Healthcare Leadership track

Shay Scott, Director, Executive MBA – Global Supply Chain track

Michael McIntyre, Director, Executive MBA – Strategic Leadership track

The Executive MBA is provided for a national and international audience of managers holding middle and upper level positions in organizations that support their attainment of an MBA degree. The students for whom this program is designed usually have ten or more years of work experience and are currently in management positions. Typical students bring a greater knowledge of business fundamentals than is true of other MBA programs. The Executive MBA places considerable emphasis on global business, strategic thinking, and individual leadership skills. In addition to the traditional Executive MBA curriculum, the program also offers specialized areas of focus (e.g., supply chain management, healthcare, and strategic leadership) providing students the opportunity to choose an area relevant to their career goals and current business trends. The program has a heavy emphasis in strategic thinking and leading-edge management concepts. The Executive MBA is the right choice for individuals who are in positions of broad responsibility or who have been designated to fulfill such roles within their organizations in the future.

The Executive MBA is a cohort based, three (consecutive) semester program completed in a period of twelve to sixteen months depending on the student's chosen area of focus. The class meets in Knoxville for residence periods approximately once per quarter starting in January and ending in December. One or more of the residence periods occur at international locations. Off campus work includes distance learning classes and requires substantial and regular contact with faculty and other participants. The project work in the Executive MBA is a large scale management project running for the duration of the program. Students work with managers in their own organizations to choose a project of significant scale and scope. Each project has a faculty advisor. Applications are accepted for January entry only. Applications are accepted on a rolling basis, with early application encouraged. Applications received after September 1 will be considered subject to space availability. The GMAT may be waived depending on work experience. Students will receive materials for study in mid-November preceding the January start date. Students whose native language is not English must take the Test of English as a Foreign Language (TOEFL) unless they are United States citizens or have earned a degree from an accredited United States college or university in the past two years. Additional information on the Executive MBA can be found at <http://execed.utk.edu/choose-mba.asp>

Rationale: Correct inaccuracies in description. Staffing Impact: None Financial Impact: None. Impact on Other Academic Units: None.

Learning Outcomes: The changes proposed are consistent with the Executive MBA program learning objectives:

1. Leadership Development: Each student will demonstrate the ability to appraise their own leadership strengths and weaknesses; create a leadership development plan with specific, measurable goals to strengthen their leadership potential, assess their progress toward those goals; and revise their plan, as necessary, to support their continued growth and development as a leader.
2. Application of Knowledge to a Real Company Project: Each student shall assimilate the knowledge of core business disciplines acquired in the classroom and directly apply this knowledge to their workplace so as to achieve the highest level of cognitive learning.
3. Decision Making in an Integrated and Global Context: By satisfactorily contributing to a team engaged in a competitive Marketplace simulation, each student shall demonstrate an ability to work cooperatively with others to identify and solve business problems in an integrated and global market environment.
4. Corporate Social Responsibility and Ethics Awareness: Each student shall demonstrate the ability to identify and analyze issues related to corporate social responsibility (CSR), ethics and organizational culture in an applied and integrated business context.

Support from assessment activities: None.

COLLEGE OF NURSING

All changes effective Fall 2017

I. PROGRAM CHANGES

REVISE NURSING MAJOR, MSN (NURSING ADMINISTRATION CONCENTRATION)

In the 2017-18 *Graduate Catalog* revise requirements under the heading, "Concentration (choose one)" for the nursing administration concentration as follows:

NURS 589, NURS 594, NURS 595, NURS 590, NURS 591 Nursing Administration I and II = 21 hours

~~Formerly: Concentration (choose one)~~

~~NURS 590, NURS 591 Nursing Administration Macro/Micro Analysis = 12 hours~~

Rationale: Corrects degree requirements for MSN, Nursing Administration concentration to reflect curriculum change made last year eliminating three 3-credit hr. elective courses students take for completion of program. Impact on other units: None. Financial impact: None.

INFORMATIONAL ITEM:

Program changes: revise Nursing major, MSN (Nursing Administration concentration).

The Curriculum Committee had questions concerning the above revision to the program requirements from 12 to 21 hours. It was noted that 9 hours of elective courses were dropped last year and 3 new courses added to replace the electives. However, the revision to the program hour requirements was not submitted in last year's proposals.

Informational Item: The Curriculum Committee recognized the above error, and with confirmation from Dr. Gunther as to the error, **the Committee voted and approved an adjustment to the current 2016-17 Graduate Catalog to revise the hours from 12 to 21 so that the current catalog will show accurate requirements for the nursing administration concentration.**

Email sent to Dr. Gunther (cc: Marian Roman and Robert Fuller). Dr. Gunther confirmed this was an oversight and approved of the immediate change to the catalog.

REVISE NURSING MAJOR, PHD

In the 2017-18 *Graduate Catalog* revise the second sentence under the heading "Doctoral Committee" as follows:

The student's comprehensive examination committee consists of the faculty serving on the student's dissertation committee.

Formerly: Doctoral Committee

The student's comprehensive examination committee consists of the faculty teaching core courses and one representative from the cognate area

Rationale: Reflects change in composition of comprehensive examination committee. Impact on other units: None. Financial impact: None.

BREDESEN CENTER FOR INTERDISCIPLINARY RESEARCH AND GRADUATE EDUCATION

All changes effective Fall 2017

I. COURSE CHANGES

ADD NEW ACADEMIC DISCIPLINE AND COURSES

Data Science and Engineering (DSE)

DSE 502 Registration for Use of Facilities (1-15) Required for the student not otherwise registered during any semester when the student uses university facilities and/or faculty time before degree is completed.

Grading Restriction: Satisfactory / No Credit grading only.

Repeatability: May be repeated.

Credit Restriction: May not be used toward degree requirements.

Registration Restriction(s): Minimum student level – graduate.

DSE 511 Introduction to Data Science and Computing I (3) Topics include: version control, scripting languages, relational and non-relational databases, proper use of data structures, introduction to data science work flows, introduction to project management, and applications.

Registration Restriction(s): Minimum student level – graduate.

DSE 512 Introduction to Data Science and Computing II (3) Topics include: platforms for scalable computing including Map Reduce, Hadoop, Spark, and HPC, setting up computing in cloud, and modern data science work flows.

Registration Restriction(s): Minimum student level – graduate.

DSE 537 Introduction to Data Analysis and Data Mining (3) Topics include: data visualization, data summaries, missing data, study design, communicating results, linear regression, ANOVA, decision trees, random forests, support vector machines, model diagnostics, cross validation, bootstrap, reproducible research skills. Hands on projects.

Registration Restriction(s): Minimum student level – graduate.

DSE 592 Internship (1-3) Individual project to further studies in data science research and allow students to engage in an established external entrepreneurship and/or policy environment.

Registration Restriction: Minimum student level – graduate; Instructor permission required.

DSE 593 Independent Study (1-3)

Repeatability: May be repeated. Maximum 9 hours.

Credit Restriction: Only 6 hours may be applied toward degree requirements.

DSE 599 Seminar (1)

Grading Restriction: Satisfactory / No Credit grading only.

Repeatability: May be repeated. Maximum 15 hours.

Credit Restriction: Only 3 hours may be applied toward degree requirements.

DSE 600 Doctoral Research and Dissertation (3-15)

Grading Restriction: P / NP grading only.

Repeatability: May be repeated

Registration Restriction(s): Minimum student level – graduate.

ADD WITH VARIABLE TITLE

DSE 597 Special Topics (1-3)

Repeatability: May be repeated. Maximum 9 hours.

DSE 697 Special Topics (1-3)

Repeatability: May be repeated. Maximum 9 hours.

Rationale: Needed for new DSE program. See details below for new program. Impact on other units: See details below for new program. Financial impact: See details below for new program.

II. PROGRAM CHANGES

+ ADD NEW MAJOR AND DEGREE (PENDING THEC APPROVAL)

DATA SCIENCE AND ENGINEERING MAJOR, PHD*

**This program is pending approval from the Tennessee Higher Education Commission. Students will be admitted to the major should the program be approved.*

The Bredesen Center for Interdisciplinary Research and Graduate Education offers a graduate program leading to the Doctor of Philosophy (PhD) degree in Data Science and Engineering (DSE). This interdisciplinary degree is a collaborative effort supported by selected faculty from various colleges at the University of Tennessee, Knoxville, the UT Health Sciences Center, the University of Tennessee, Chattanooga, and research staff of Oak Ridge National Laboratory. These research and educational leaders are appointed as faculty members of the Bredesen Center for Interdisciplinary Research and Graduate Education. Members of the Bredesen Center faculty determine the curriculum and serve as the primary resource for the teaching, research, and mentoring of the students admitted to the program. The Bredesen Center Graduate Admissions Committee makes decisions on admissions, transfer, evaluation, and continuation of graduate students in the program.

Admission Requirements

In order to be admitted to the PhD program in data science and engineering, student applicants must fulfill the general admission criteria for the Graduate School of the University of Tennessee Knoxville. In addition, the student must have a Bachelor of Science degree in either engineering or a scientific field (e.g., analytics, biology, chemistry, computational science, mathematics, physics, statistics, etc.), or the equivalent. Students with other undergraduate degrees may also be admitted on a case-by-case basis by the Bredesen Center Graduate Admissions Committee. Dependent on the student's background, additional coursework may be required to satisfy co- and prerequisites.

Requirements

A minimum of 72 hours is required beyond the bachelor's degree, exclusive of credit for an MS thesis, and completion of the core requirements, as outlined in the section on Course Requirements. Of this number, a minimum of 24 and up to 36 hours of course 600 Doctoral Research and Dissertation and six hours of 600-level coursework at UTK will be required.

No later than one year after entering the program, each student must take a qualifying examination. A student must pass the qualifying examination to proceed in the PhD program and to engage in dissertation research.

No later than the first semester of the fourth year following entrance into the PhD program, each student must take and pass a comprehensive examination that includes presentation and approval of the proposed dissertation research. After passing the comprehensive exam, the student should submit the Admission to Candidacy Application to the Graduate School. Admission to candidacy indicates that the student has demonstrated the ability to do acceptable work in the area of study and has made satisfactory progress toward the degree. This action usually connotes that all prerequisites to admission have been completed and the program of study/research has been approved (see details in a later section).

After completion of the dissertation, prior to graduation, each student must pass a dissertation defense examination administered by the student's doctoral committee.

Course Requirements

Out of the 72 hours required for the program, 36 hours of coursework is required beyond the BS degree. The following 36 hours of coursework or their equivalent must be completed at a minimum, including the Core Curriculum for Data Science, a Knowledge Breadth Curriculum, a Knowledge Specialization for Domain Science Curriculum, and Seminar Series, as summarized below. Students with Master's degrees must complete at least 24 hours of graduate coursework. Students must fulfill all requirements for the Core Curriculum, the Knowledge Breadth Curriculum, Knowledge Specializations for Domain Science, and the Seminar Series utilizing both MS and PhD coursework as appropriate and approved by the department.

A. Core Curriculum for Data Science (21 hours)

Students must complete 21 hours in the following core courses (or substitute, approved in advance).

DSE 511
DSE 512
DSE 537
MATH 525 / STAT 563
MATH 526
MSE 510
BZAN 645 / BZAN 646 / ECE 571

B. Knowledge Breadth Curriculum (6 hours)

Students must complete six hours by selecting appropriate courses in the following areas.

- Political, social, legal, ethical, and security issues related to data issues
- Entrepreneurship, leadership, and management

C. Knowledge Specialization Curriculum for Domain Science (6 hours)

Students must choose courses from participating departments and approved by the Bredesen Center's Assistant Director for Data Science related to the following disciplines.

- Health and Biological Sciences
- Advanced Manufacturing
- Materials Science
- Environmental and Climate Science
- Transportation Science
- National Security
- Urban Systems Science
- Advanced Data Science

D. DSE 599 Seminar (3 hours)

Advisor/Major Professor

Each graduate student must have an advisor/major professor. This professor advises the student about course selection, supervises the student's research, and facilitates communication within the degree program and/or student's major department, to other departments, and with the Graduate School relative to requirements. A temporary advisor may be assigned to direct the entering student's work during the period in which the student is becoming acquainted with the institutions and determining the focus of research interests. Once the major professor is determined, the major professor and the student together select a doctoral committee. The student is expected to maintain close consultation with the major professor and other members of the doctoral committee with regard to progress in the program.

Doctoral Committee

The major professor directs the student's dissertation research and chairs the doctoral committee. The student and major professor identify a doctoral committee composed of at least four faculty members holding the rank of assistant professor or above, three of whom, including the chair, must be approved by the Graduate Council to direct doctoral research. At least one member must be outside the Bredesen Center faculty. Committee members should be chosen to ensure multidisciplinary breadth. The Center Director has oversight responsibility to ensure the multidisciplinary nature of the committee. A doctoral student, in collaboration with the major professor, should begin to form the doctoral committee during the first year of study. Once formed, the doctoral committee, by request of the major professor, will meet as a group with the student to ensure timely progress toward the degree. At a minimum, the committee should meet at least once during each academic year.

Admission to Candidacy

Admission to candidacy indicates that the student has demonstrated ability to do acceptable graduate work and that satisfactory progress has been made toward the degree. This action usually connotes that all prerequisites to admission have been completed and a program of study has been approved.

A student may be admitted to candidacy for the doctoral degree after passing the comprehensive examination and maintaining at least a B average in all graduate coursework. Each student is responsible for filing the Admission to Candidacy form. ~~which lists all graduate courses to be used for the degree, including courses taken at the University of Tennessee or at other institutions prior to admission to the doctoral program. The Admission to Candidacy form is signed by the doctoral committee.~~

Graduate Student Examinations

This section provides a description of the graduate student examination requirements for the PhD degree program. Three examinations are required as part of the doctoral program: qualifying examination, comprehensive examination, and defense of dissertation examination.

Qualifying Examination

The qualifying examination is developed, administered, and graded by the faculty (or designated subset of the faculty) of the PhD program under the coordination of the Bredesen Center Director. The Data Science and Engineering doctoral program requires students to be able to investigate and conduct research on a variety of problems. The qualifying examination tests the capabilities of a student through the preparation of a professional quality investigative research report and accompanying presentation that addresses one of several questions in data science and engineering. In case of failure, the candidate may appeal to retake the examination through the Bredesen Center Graduate Curriculum Committee within 30 days of notification of the result. If the appeal is granted, the student must retake the examination at the next offering. The result of the second examination is final. Completion of the qualifying exam enables students to begin working on dissertation research.

Comprehensive Examination

The Comprehensive Examination may be completed as early as the end of the second year following entrance into the PhD program and prior to admission to candidacy. Students should aim to complete the comprehensive exam by the end of the third year and must complete it no later than the first semester of the fourth year unless extenuating circumstances are involved. The timing is late enough in a student's academic program to permit most of his/her graduate course work to be covered on the examination, and early enough to permit modification of the student's program based on the results of the exam.

Two requirements must be satisfied before a student takes the Comprehensive Examination.

1. A written Dissertation Proposal, approved by the major professor, must be submitted to each member of the student's Doctoral Committee two weeks prior to the examination.
2. Each member of the student's Doctoral committee must agree that the student is ready to take the Comprehensive Exam. The committee member will communicate to the major professor when they are satisfied that the student is ready to take the Comprehensive Exam.

The Comprehensive Examination will consist of the student constructing and defending his or her dissertation research proposal to the committee in a format deemed acceptable by the student's Doctoral Committee. Typically, an oral defense is sufficient for this examination, although a written component may be administered by the committee at their discretion. Once the Comprehensive Examination is passed, the student should file for and be admitted to candidacy. At the discretion of the Doctoral Committee, supplemental reexaminations for the Comprehensive Examination and/or proposed dissertation research may be required. In case of failure, the candidate may not apply for reexamination until the following semester. The result of the second examination is final.

Defense of Dissertation Examination

A doctoral candidate must pass an oral examination on the dissertation. The dissertation, in the form approved by the major professor, must be distributed to the committee at least two weeks before the examination. The examination must be scheduled through the Graduate School at least one week prior to the examination and must be conducted in university-approved facilities. The examination is announced publicly and is open to all students and faculty members. The defense of dissertation will be administered by all members of the doctoral committee after completion of the dissertation and all course requirements. This examination must be passed at least two weeks before the date of submission and acceptance of the dissertation by the Graduate School. The major professor must submit the results of the defense by the dissertation deadline.

Supporting Information:

Task Force. In July 2015, UTK Chancellor Jimmy Cheek and ORNL Director Thom Mason convened a Task Force to study opportunities for research and education in data science. The task force was composed of 11 top researchers from ORNL, 11 faculty experts from UTK, the Dean of the UTK Graduate School, a UT/ORNL Governor's Chair at the UT Health Sciences Center, and the head of the Computer Science and Engineering Department from UT Chattanooga. The task force identified seven key areas where future progress will depend critically on the ability to analyze big data: health and biological sciences, advanced manufacturing, materials science, environmental and climate science, transportation science, national security, and urban systems science. Beyond being areas of strength and existing investment, these areas are all priorities for the State of Tennessee.

UT leadership. A meeting on August 1, 2016 was held with Dean Dixie Thompson, Vice President Katie High, Associate Vice President India Lane, and Associate Vice Provost Mary Albrecht to lay out the DSE proposal idea and to understand the steps needed for approval. There is strong support by each of these individuals for proceeding with this approval process.

Provost. A meeting will be held on August 24, 2016 to build on informal discussions in the past and lay the groundwork for approval from the provost.

THEC. After the August 1 meeting, India Lane sent the following letter of notification concerning DSE to Betty Dandridge at THEC, as copied below.

August 1, 2016

To: Ms. Betty Dandridge-Johnson

From: India Lane and Katie High, UT Office of Academic Affairs and Student Success

Re: Letter of Notification: UTK/ORNL Data Science and Engineering (DSE) PhD Proposal; Proposed CIP: TBD

The University of Tennessee, Knoxville (UTK) and Oak Ridge National Laboratory (ORNL) are again partnering to develop a world-class, contemporary PhD program. We now live in the world of "big data," the massive amounts of information streamed from health records, GPS, cellphones, traffic sensors, climate sensors and other sources. This PhD program will recruit and train elite caliber students to apply data science and "big data" technology to solve critical problems in areas such as healthcare, biological science, advanced manufacturing, materials science, environmental science, transportation and national security.

Based on the highly successful model of the Energy Science and Engineering PhD program, the proposed program will be an interdisciplinary PhD leveraging the talent and resources available across UT and ORNL. The program is well-suited within the mission and strategic plan of UTK to increase research efforts and graduate student education and serves the state's master plan to increase doctoral degrees in high demand fields. An ad-hoc task force has already been formed and convened to frame the overall goals and format of the program. The full Letter of Application is in preparation for a proposed implementation date of August, 2017.

The extensive resources of ORNL, as well as UTK and other UT campuses will provide equipment, supercomputers and faculty mentors. Faculty participation is also expected from UT, Chattanooga and the UT Health Science Center in specialized areas of expertise. Governor Haslam has committed significant start-up funding to develop and house the program within the Bredesen Center for Interdisciplinary Research and Graduate Education. After the first year of the program, graduate student stipends are typically funded by research grants.

We are unaware of any similar programs under development in the region but recognize potential competitors at elite institutions world-wide. In the United States, institutions including MIT, Duke, Stanford and the University of Michigan are investing in "big data" research and graduate programs.

We plan to complete the Letter of Application this fall to accommodate a site visit review before the end of the calendar year. If the timetable stays on track, UTK Graduate School and UT Board of Trustees approvals will proceed through early spring, leading to THEC review in April 2017. Please let me know if you have any concerns or questions about this proposal as we proceed.

Rationale: The University of Tennessee, Knoxville and Oak Ridge National Laboratory propose a new interdisciplinary PhD program in Data Science and Engineering (DSE). The program will recruit students from the world's leading institutions and train them to apply data science and "big data" technology to solve critical problems in science, engineering, and society at large. The program focuses on seven research areas: health and biological sciences, advanced manufacturing, materials science, environmental and climate science, transportation science, national security, and urban systems science. Since these areas are priorities for the State of Tennessee, the new DSE doctoral program will meet the state's growing need for data analytics specialists.

The potential for big data analysis is limitless and current research is necessary to identify how to extract new information when analyzing large disparate data sources. For example, by analyzing electronic health records on a massive scale, we can identify ways to improve patient care and reduce costs. Combining data from cellphones, GPS, and traffic sensors can improve traffic flow and emergency responsiveness.

Many leading institutions—such as Cambridge, MIT, Duke, and Stanford—recognize the potential of big data analysis and are investing in this area. For example, the University of Michigan recently announced a new \$100 million initiative aimed at working with big data to allow research into areas like driverless cars, medicine, and climate change.

The Bredesen Center's Energy Science and Engineering (ESE) PhD program has experienced tremendous success since its creation six years ago. Enrollment has grown to 138 doctoral students working on dissertation research in various areas relating to energy. The program also has a focus on entrepreneurship and several students have received investor funds to bring their research to market. The ESE program attracts top-tier students from around the world with 35 international students from Africa, Asia, the Middle East, and South America. The Bredesen Center is home to 11 national fellowship recipients, including National Science Foundation Graduate Fellowship (3), the National Defense Science and Engineering Graduate Fellowship (2), the Nuclear Nonproliferation and International Safeguards Fellowship (2), the Hydro Research Foundation Fellowship, the Nuclear Forensics Graduate Fellowship, and the Nuclear Energy University Program Fellowship. The Bredesen Center is also home to one of UT's four newest Fulbright Fellows.

By duplicating the ESE program's successful model as well as leveraging the vast expertise and relationship between UTK and ORNL, the two institutions have a unique opportunity to become a national leader in the area of data science and big data analytics.

Administration will include a director from UTK and assistant directors from ORNL, the UT Health Sciences Center (UTHSC), and the University of Tennessee at Chattanooga (UTC) and UTK.

Impact on other units: The DSE impact on other units will be substantial in various ways. Research output and collaborations. Data science is an interdisciplinary area, combining technical skills and innovation in areas of computer science, mathematics, and statistics with the big data challenges in a host of domain areas, including health and biological sciences, advanced manufacturing, materials science, environmental and climate science, transportation science, national security, and urban systems science. The interdisciplinary nature of the program will foster collaborations between faculty in various units leading to new areas of research and successful grant applications.

Courses. The Bredesen Center will develop new courses involving core topics related to data science and analytics, adding to existing departmental courses that relate to data science. Courses developed by the Bredesen Center (e.g., DSE511, 512, and 537) would be attractive to graduate students enrolled in disciplinary graduate programs in various departments at UTK. In addition, DSE degree students would enroll in disciplinary courses in associated departments enhancing enrollments. The Bredesen Center's DSE directors will work closely with the departments teaching required core courses and will advise those departments of the potential for increased enrollments.

Graduate student recruiting. As with the ESE doctoral program, the Bredesen Center will recruit to UTK top graduate students from across the country and the world - students who would not have come to UTK for a specific disciplinary doctoral program. The DSE students will perform cutting edge dissertation research with affiliated faculty from departments at UTK and ORNL, thereby increasing the research output of both institutions. In addition, students of high caliber demonstrate their innovation and drive by organizing initiatives in various aspects of university life, e.g., Bredesen Center grad student leadership in forming and running a local Women in STEM Research Symposium in April of the last two years. As with the ESE program, the recruiting process will also generate referrals for strong graduate students to existing disciplinary programs.

System-wide collaboration. Data science is an area in which various units of the UT system can make substantial contributions. The University of Tennessee Health Sciences Center will play a role in the DSE doctoral program by virtue of faculty expertise in data science relative to the health care field. UT Chattanooga will contribute through its College of Engineering and Computer Science and, in particular, via the SimCenter, which integrates data science with core strength in applied computational simulations.

Benefit to the State of Tennessee. Data science, engineering, and analytics are areas of great importance to the State of Tennessee and offer great potential value in both increased efficiency at the government level and in growth and development for entrepreneurial and existing enterprises. The supercomputing facility at ORNL (currently the second largest computer in the world) can be leveraged in this field to benefit the State of Tennessee in many ways. Electronic health records, when analyzed on a massive scale, should be able to identify more efficient and effective ways to treat patients. Cell phones, GPS technology, and traffic sensor data can be combined to improve traffic flow and react to emergencies more quickly and effectively. Big data repositories on the web will allow people to electronically access, share, and create music, arts, literature, and other cultural activities in new and innovative ways. The DSE doctoral program will meet Tennessee's growing need for data analytics specialists, for science, health care, transportation, and a host of other industries.

Financial impact: A proposed one-time \$6 million allocation from the State of Tennessee will fund the new DSE program. The Bredesen Center would house the program and it would follow the Center's current model which allows for a partial return of off-campus overhead and tuition to replenish initial student funding expenses. The Bredesen Center is prepared to fund course instruction for the core curriculum when necessary.