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Educational Policies Committee Program Proposal, College of Engineering, September 15, 2017 - On-Line Certificate in Engineering Education

Utah State University

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Utah System of Higher Education
New Academic Program Proposal
Cover/Signature Page - Abbreviated Template

Institution Submitting Request: Utah State University
 Proposed or Current Program Title: On-Line Certificate in Engineering Education
 Sponsoring School, College, or Division: Engineering
 Sponsoring Academic Department(s) or Unit(s): Engineering Education
 Classification of Instructional Program Code¹ : 14.9999
 Min/Max Credit Hours Required of Full Program: 13 / 13
 Proposed Beginning Term²: Fall 2017
 Institutional Board of Trustees' Approval Date: 05/05/17

<input type="checkbox"/> Certificate of Proficiency	<input type="checkbox"/> Entry-level CTE CP	<input type="checkbox"/> Mid-level CP
<input type="checkbox"/> Certificate of Completion		
<input type="checkbox"/> Minor		
<input checked="" type="checkbox"/> Graduate Certificate		
<input type="checkbox"/> K-12 Endorsement Program		
<input type="checkbox"/> NEW Emphasis for Regent-Approved Program		
<input type="checkbox"/> Out of Service Area Delivery Program		

Chief Academic Officer (or Designee) Signature:

I, the Chief Academic Officer or Designee, certify that all required institutional approvals have been obtained prior to submitting this request to the Office of the Commissioner.

Edward M. Reeve Date: **06/21/17**

I understand that checking this box constitutes my legal signature.

¹ For CIP code classifications, please see <http://nces.ed.gov/ipeds/cipcode/Default.aspx?y=55>.

² "Proposed Beginning Term" refers to first term after Regent approval that students may declare this program.

Utah System of Higher Education Program Description - Abbreviated Template

Section I: The Request

Utah State University requests approval to offer the following Graduate Certificate: On-Line Certificate in Engineering Education effective Fall 2017. This program was approved by the institutional Board of Trustees on

Section II: Program Proposal/Needs Assessment

Program Description/Rationale

Present a brief program description. Describe the institutional procedures used to arrive at a decision to offer the program. Briefly indicate why such a program should be initiated. State how the institution and the USHE benefit by offering the proposed program. Provide evidence of student interest and demand that supports potential program enrollment.

The certificate program emphasizes the learning and teaching of engineering with the goals of producing graduates that are familiar with the theory and practice of effective engineering education, are adept at these aspects within their specific area of engineering specialization, and have the ability to develop, implement and assess engineering curricula.

To achieve these goals, students will complete 13 credit hours, combining course work (12 credits) and a comprehensive teaching and learning portfolio (1 credit). The curriculum has been divided into four 3 credit courses and an Internship course as shown below.

Labor Market Demand

Provide local, state, and/or national labor market data that speak to the need for this program. Occupational demand, wage, and number of annual openings information may be found at sources such as Utah DWS Occupation Information Data Viewer (jobs.utah.gov/jsp/wi/utalmis/gotoOccinfo.do) and the Occupation Outlook Handbook (www.bls.gov/oco).

Rapid changes in the worldwide engineering enterprise have motivated the engineering profession to rethink how future generations of engineers should be educated with expertise in teaching and learning. To educate future engineers there is a need to better prepare them for critical elements of teaching and learning, and in particular in curriculum design, evaluation and assessment, principles of teaching and learning, and training development.

Utah State University (USU) is home to one of only a few departments in the nation in engineering education. The engineering education program at USU is one of a growing number of programs throughout the country. The proposed certificate program will provide skills for students interested in enhancing their teaching and training skills in engineering. The proposed Graduate Certificate in Engineering Education is an initial certificate, however on a case-by-case basis, with advisement from the engineering education department, credits earned may be used toward completing a Ph.D. in Engineering Education.

Often, newly graduating engineering faculty are ill-prepared to effectively teach and many struggle as they move toward tenure. There is a need to give engineering faculty and industrial trainers an opportunity to improve their knowledge and skills in engineering teaching and learning.

The Department of Engineering Education completed a national survey of engineering education institutions (both academic and businesses) to determine the need for the program. The results of the survey indicate that potential participants would prefer to participate in an online program that could be completed within 12 months. The participants in the survey also commented on the topics that should be included in the program curriculum. The requests regarding the content of the program are reflected in the program structure and content as presented in the following sections of this document.

While there are already engineering education certificate programs at other universities, none are fully online programs. The Graduate Certificate in Engineering Education program will be open to students without geographic limitations here in the U.S. and in other countries worldwide.

Consistency with Institutional Mission/Impact on Other USHE Institutions

Explain how the program is consistent with the institution's Regents-approved mission, roles, and goals. Institutional mission and roles may be found at higheredutah.org/policies/policyr312/ . Indicate if the program will be delivered outside of designated service area; provide justification. Service areas are defined in higheredutah.org/policies/policyr315/ .

The mission of Utah State University is to be one of the nation's premier student-centered land grant and space grant universities by fostering the principle that academics come first; by cultivating diversity of thought and culture; and by serving the public through learning, discovery, and engagement. The online certificate program meets the university mission by serving the public and promoting learning environments, discovery, and engagement to improve engineering.

The existing faculty in the Department of Engineering Education (EED) will participate in facilitating the certificate program. There will be no need for additional faculty or other resources to facilitate the program. The certificate program will require four new courses to be developed. Each of the courses will utilize content from existing courses in the Ph.D. program. The courses will be developed for online delivery by existing EED faculty. There will be no negative budgetary impact on USU.

Finances

What costs or savings are anticipated in implementing the proposed program? If new funds are required, indicate expected sources of funds. Describe any budgetary impact on other programs or units within the institution.

No new funds are required for the implementation of the online certificate program. The program will not impact other programs at Utah State University and will enhance the existing Ph.D. program within the department by offering an online option for students across the US and around the world. A 5 year proposed budget plan is illustrated in the table below.

	Year 1	Year 2	Year 3	Year 4	Year 5	Five Year Total
STUDENTS						Totals
Non-Resident	10	11	12	14	15	62
REVENUES						
Tuition \$394/credit						
1 student x 13 credits x \$394	\$51,220	\$56,342	\$61,464	\$71,708	\$76,830	\$317,564
EED Fees	\$15,600	\$17,160	\$18,720	\$21,840	\$23,400	\$96,720
Differential Tuition	\$8,970	\$9,867	\$10,764	\$12,558	\$13,455	\$55,614
	\$75,790	\$83,369	\$90,948	\$106,106	\$113,685	\$469,898
EXPENSES						
Tuition Expenses (\$394 - \$197)	\$25,610	\$28,171	\$30,732	\$35,854	\$38,415	\$158,782
Faculty Salary	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$100,000
Faculty Benefits (48%)	\$9,600	\$9,600	\$9,600	\$9,600	\$9,600	\$48,000
Graduate Student Support	\$19,800	\$19,800	\$19,800	\$21,220	\$21,220	\$101,840
Graduate Benefits (8%)	\$1,584	\$1,584	\$1,584	\$1,698	\$1,698	\$8,147
Insurance (8% increase/year)	\$1,584	\$1,711	\$1,848	\$1,995	\$2,155	\$9,293
Marketing/Recruitment	\$5,000	\$5,000	\$5,000	\$5,000	\$5,000	\$25,000
TOTAL EXPENSES	\$83,178	\$85,866	\$88,564	\$95,367	\$98,088	\$451,062

Section III: Curriculum

Program Curriculum

List all courses, including new courses, to be offered in the proposed program by prefix, number, title, and credit hours (or credit equivalences). Indicate new courses with an X in the appropriate columns. The total number of credit hours should reflect the number of credits required to receive the award. For NEW Emphases, skip to emphases tables below.

For variable credits, please enter the minimum value in the table below for credit hours. To explain variable credit in detail as well as any additional information, use the narrative box below.

		Course Number	NEW Course	Course Title	Credit Hours
General Education Courses (list specific courses if recommended for this program on Degree Map)					
General Education Credit Hour Sub-Total					
Required Courses					
+	-	Course Design	X	Developing educational or training curricula, including the	3
+	-	Evaluation and Assess	X	An overview of the various methods used to measure and evaluate	3
+	-	Principles of Teaching	X	Learning theories, desirable characteristics, attributes, learning	3
+	-	E-learning Course and	X	Review of learning theories and research for development of online	3
+	-	Teaching Internship	X	Capstone activity for students to gain experience, improve	1
+	-				
+	-				
+	-				
+	-				
+	-				
Add A Group of Courses					
Required Course Credit Hour Sub-Total					13
Elective Courses					
+	-				
+	-				
+	-				
+	-				
+	-				
+	-				
+	-				
+	-				
+	-				
+	-				
Add A Group of Courses					
Elective Credit Hour Sub-Total					
Core Curriculum Credit Hour Sub-Total					13

Program Curriculum Narrative

Describe any variable credits. You may also include additional curriculum information, as needed.

Certificate Courses

EEDC 6450 Principles of Teaching and Learning

Course Description

The course provides opportunities for students to develop skills, strategies, and techniques used for instruction in engineering education. It also gives a chance to **think** about teaching and learning in engineering at the university and in industry. Topics covered in this course include: ways to improve efficiency as an engineering educator, problem-solving and creativity, active learning strategies, different content delivery methods, different types of learners, Piaget's and Perry's theories of cognitive development, Constructivism, different learning and teaching styles.

Course Objectives

After completing this course the students will be able to:

- Explain the different learning theories and be able to incorporate them into their teaching
- Describe the different models of cognitive development
- Classify different psychological types and explain how they learn
- Explain the difference between novices and experts and discuss steps in problem solving strategy
- Recognize the responsibilities that come with teaching
- Set goals and prioritize activities
- Discuss the advantages and disadvantages to different delivery mechanisms
- Recognize and employ active learning strategies
- Effectively use technology in and out of the classroom
- Apply effective communication and presentation skills
- Incorporate laboratory work, group and team activities/projects, and other practical skills into a course/training
- Apply effective classroom management

Course Content

The course will be organized around the following teaching and learning topics. Specific assignments and activities have been developed for each topic section.

- Learning theories and how people learn
- Cognitive development theories: Piaget and Perry, Vygotsky
- Importance of teacher training
- Teaching and research efficiency
- Problem solving and creativity
- Content delivery methods
- Active learning strategies and teaching with technology

- Incorporating design and laboratory work
- Classroom management with special consideration of difficult students

Course Requirements

- Assigned Text Readings - complete the assigned readings from recommended texts
- Online Readings - complete selected online readings related to the course sequence
- Online Class Discussion - participate in online class discussion
- Topic Activities - complete assigned activities for each topic

References:

Wankat, P.C. and Oreovicz, F.S. (2015). *Teaching Engineering* (2nd Edition), Purdue University Press. ISBN 978-1557537003).

EEDC 6150 Evaluation and Assessment

Course Description

The purpose of this course is to facilitate each student reaching a level high of competence and understanding of assessment practices used in engineering education. The focus of this course will be the nature of assessment, planning for assessment, validity and reliability, preparing and using achievement tests, writing traditional test questions (T/F, matching, multiple choice, etc.), more authentic assessment methods, grading and reporting, and using assessment in action research.

Course Objectives

After completing this course the students will be able to:

- Discuss the relationship between instruction and assessment
- Apply taxonomies and instructional objectives to prepare students for assessment
- Identify methods used for assessment of learning
- Explain the advantages and disadvantages in the major types of assessment
- Describe the difference between norm referenced and criterion reference assessment
- Develop standards for student assessment
- Select and develop assessment methods appropriate for instructional decisions
- Explain the importance of validity and reliability in assessment
- Develop guidelines for effective and fair grading
- Collect appropriate assessment data
- Recognize the unethical, illegal, and otherwise, inappropriate assessment methods and uses of assessment information

Course Content

The course will be organized around the following topics related to evaluation and assessment.

- Achievement assessment and the relationship between assessment and instruction
- The nature of student assessment
- Planning for assessment
- Validity and Reliability
- Preparing and using achievement tests
- The nature and creation of selection item type questions
- Performance assessments
- Grading and Reporting

Course Requirements

- Assigned Text Readings - complete the assigned readings from recommended texts
- Online Readings - complete selected online readings related to the course sequence
- Online Class Discussion - participate in online class discussion
- Topic Activities - complete assigned activities for each topic

References:

Waught, C.K. and Gronlund, N.E. (2013). *Assessment of Student Achievement* (10th Edition), Pearson, ISBN 978-0-13-268963-2

EEDC 6090 Course Design

Course Description

The aim of this course is to teach the students the necessary skills to create an effective educational or training engineering curricula. The course will focus on the different types of engineering courses (lectures, recitations, labs, design studios, etc.), creating goals and objectives, choosing effective teaching methods, choosing course reference materials, accreditation concerns, lesson planning, and course design.

Course Objectives

After completing this course the students will be able to:

- Identify different types courses applicable for engineering education
- Identify functions and implications of various curriculum designs
- Develop an effective course/training program aligned with accreditation requirements
- Create objectives and goals for the course/training
- Identify effective teaching and learning methods for the course/training
- Identify instructional delivery methods that enhance student learning and achievement
- Develop effective assessment strategy for the course/training
- Create a list of resources essential for the course (e.g. textbooks, etc.)
- Continuous course evaluation process

Course Content

The course will be organized around the following curriculum topics. Specific assignments and activities have been developed for each topic section.

- Character of course curriculum and its history
- Approaches and importance of course curriculum
- Students expectations of the course curriculum
- Curriculum development process
- Curriculum planning and implementation
- Planning learning activity and instruction
- Planning and implementation of student assessment
- Curriculum evaluation and change
- Planning course reading material and other resources

Course Requirements

- Assigned Text Readings - complete the assigned readings from recommended texts
- Online Readings - complete selected online readings related to the course sequence

- Online Class Discussion - participate in online class discussion
- Topic Activities - complete assigned activities for each topic

References:

Grunet, J., Millis, B.J., Cohen, M.W. and Diamong, R.M. (2008). *The Course Syllabus: A Learning-Centered Approach* (2nd Edition), Wiley, ISBN: 978-0470197615.

EEDC 7310 E-learning Course and Training Development

Introduction

The purpose of this course is to introduce core principles and the best practices of the design and implementation of online or web-assisted courses in the context of engineering education. The focus of this course is on the integration of research findings and best practices of online teaching and learning as well as tips and strategies for online course development and implementation.

Course Objectives

After completing this course the students will be able to:

- Explain different course delivery formats
- Discuss different types of online formats
- Explain the learning theories that support online education
- Effectively use and manage a learning management system
- Implement instructional tools and strategies in web-facilitated and online learning environments with specific reference to engineering education
- Develop and implement an online or web-facilitated course in engineering, or related, field

Course Content

The course will be organized around the following topics related to technology.

- Face-to-Face and Web Facilitated instructions
- Distance Education - Hybrid/Blended and Online instructions
- Educational, Administrative, and Online Education Standards
- Principles of online instruction and delivery
- Active learning in online education in context of engineering education
- Design strategies for online course
- Assessment in online engineering education
- Instructor role in online engineering education
- Ethical issues in online education

Course Requirements

- Assigned Text Readings - complete the assigned readings from recommended texts
- Online Readings - complete selected online readings related to the course sequence
- Online Class Discussion - participate in online class discussion
- Topic Activities - complete assigned activities for each topic

References:

Boettcher, J.V. and Conrad, R-M. (2016). *The Online Teaching Survival Guide: Simple and Practical Pedagogical Tips* (2nd Edition), Jossey-Bass, ISBN 978-1119147688

EEDC 7900 Teaching Internship

Introduction

The course aims to be a capstone activity for students pursuing Graduate Engineering Education Certificate to gain experience, improve understanding of teaching, reflect on their own teaching, and obtain feedback from faculty members and possibly from students.

The course should give students the opportunity to put their engineering education knowledge into practical application. Ideally, to register for the course students should have a significant teaching responsibility in engineering or science course(s), either at the university, community college, other institution of higher learning or industry.

Course Objectives:

After completing this course the students will be able to:

- contrast critically student's teaching experience with theoretical knowledge gained in courses of the program,
- evaluate teaching experiences by using own reflections, students and faculty feedback,
- present teaching credentials by demonstrating teaching methods and approaches, and by analyzing evidence of student learning,
- articulate and justify the choices of teaching methods and activities,
- document professional development and to identify areas for improvement,
- assemble a teaching portfolio that highlights the quality and scholarship of one's own teaching in a presentable form, also for hiring purposes.

Course Content

The course will be organized around the following topics related to teaching experience and preparation of teaching portfolio.

- Teaching philosophy,
- Teaching methods and approaches,
- Teaching skills,
- Documenting of professional development,
- Preparing a teaching portfolio
- Identifying areas for improvement.

Course Requirements

Students enrolled in the course will be required to:

- read recommended material,
- submit fortnightly reflections on their teaching,
- prepare a professional teaching portfolio

References:

Separate reading material for each topic in the form of research papers.

Degree Map

Degree maps pertain to undergraduate programs ONLY. Provide a degree map for proposed program. Degree Maps were approved by the State Board of Regents on July 17, 2014 as a degree completion measure. Degree maps or graduation plans are a suggested semester-by-semester class schedule that includes prefix, number, title, and semester hours. For more details see <http://higheredutah.org/pdf/agendas/201407/TAB%20A%202014-7-18.pdf> (Item #3).

Please cut-and-paste the degree map or manually enter the degree map in the table below

Toggle Cut-and-Paste

Toggle Table