Graduate Certificate in Computer Engineering
North Carolina State University

This request has been reviewed and approved by the appropriate campus committees and authorities.

Endorsed By:

[Signature]

Head, Department/Director of Graduate Program (Printed Name and Signature) 10/31/18

Recommended By:

[Signature]

Chair, College Graduate Studies Committee (Printed Name and Signature) 11/16/18

Endorsed By:

[Signature]

College Dean (Printed Name and Signature) 11/16/18

Recommended By:

[Signature]

Vice Provost, DELTA (if DE degree) (Printed Name and Signature) 1/15/19

Approved By:

[Signature]

Dean of the Graduate School (Printed Name and Signature) 8/22/19

Recommended By:

[Signature]

Dean's Council (Printed Name and Signature) 8/26/19

Approved By:

[Signature]

Executive Vice Chancellor and Provost (Printed Name and Signature) 9/27/19

Approved By:

[Signature]

Chancellor (Printed Name and Signature) 11/13/19

(revised August 2015)
NC State University
Certificate Proposal Form

Certificate Title: Graduate Certificate in Computer Engineering
New: X
Revision: □

Classification of Instructional Programs (CIP) Discipline # (6 digits): 14.0901
*Please ensure that you select the appropriate CIP code for your certificate program. Please consult this website for more information about CIP codes: https://nces.ed.gov/ipeds/cipcode/default.aspx?y=55

Certificate Type:
On-Campus: □ Distance: □ On-Campus & Distance: X

Proposed Effective Date: Fall 2019

Director of the Certificate Program: Paul Franzon
Program Coordinator (if different from Director): N/A
Graduate Services Coordinator: Fenile Jones
College: College of Engineering
Department/Program: Electrical and Computer Engineering

Catalog Description:
The Graduate Certificate in Computer Engineering provides students with advanced academic credentials in Computer Engineering. The program is intended for professional development and may be tailored to individual requirements.

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<td>Yr. 4-12</td>
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Attachments:
☐ Proposal Document
☐ Statement of other departments likely to be affected and summary of consultation with those departments
☐ Program-level assessment
☐ Campus Routing Form
☐ Signature Page
Graduate Certificate in Computer Engineering

Program Justification
The Electrical and Computer Engineering (ECE) department proposes to offer a Graduate Certificate Program (GCP) in Computer Engineering (CPE). This program is primarily intended for individuals who wish to increase their knowledge and skills in Computer Engineering either for future career opportunities or in preparation for graduate studies. Students who complete the certificate will gain in-depth knowledge in Computer Engineering concepts, methods and tools. We anticipate that professionals interested in the CPE GCP will enroll as distance education students through Engineering Online (EOL). Many Computer Engineering courses are already being offered through EOL as part of the existing Master of Computer Engineering distance education degree program. The CPE GCP will also be available to on-campus graduate students in the sciences and engineering who want to expand their knowledge of the field.

Program Objectives
1. In this certificate program, students will learn advanced concepts, methods and tools of Computer Engineering and apply them to a variety of computer engineering problems and tasks.
2. The certificate program will provide an educational experience that satisfies the expectations of its graduates.

Program of Study
The CPE GCP requires a total of 12 credit hours of graduate-level Computer Engineering courses taken for a letter grade. There is no prescribed list of courses for the certificate; students may take a combination of courses tailored to their interests and needs, subject to course prerequisites.

The following courses are permitted to be counted towards the degree.

- Any course listed in the ECE Graduate handbook in Appendices A, B or C as falling into the “CPE” major or the “EE/CPE” major, EXCEPT for the following courses:
  - Special topics courses, i.e. courses with numbers starting with ECE 592, ECE 791 or ECE 792
  - 600 and 800 level course including ECE 600, 633, 634, 650, 695, 699, 833, 834, 895, 896 or 899

A list of courses the currently satisfy these rules are as follows:

CPE COURSES
ECE(CSC) 506 - Architecture Of Parallel Computers
ECE 517 - Object-Oriented Design and Development
ECE 546 – VLSI Systems Design
ECE(CSC) 547 - Cloud Computing Technology
ECE 560 – Embedded System Architectures
ECE 561 - Embedded System Analysis and Optimization
ECE 563 - Computer Design and Technology
ECE 564 - ASIC and FPGA Design with Verilog
ECE 566 - Compiler Optimization and Scheduling
ECE(CSC) 570 - Computer Networks
ECE(CSC) 573 - Internet Protocols
ECE(CSC) 574 - Computer And Network Security
ECE(CSC) 575 - Introduction To Wireless Networking
ECE(CSC) 576 - Networking Services: Qos, Signaling, Processes
ECE(CSC) 577 - Switched Network Management
ECE(CSC)(OR) 579 - Introduction To Computer Performance Modeling
ECE 705 - Memory Systems
ECE 706 - Advanced Parallel Computer Architecture
ECE 720 - Electronic System Level and Physical Design
ECE 721 - Advanced Microarchitecture
ECE 745 - ASIC Verification
ECE(CSC) 773 - Advanced Topics In Internet Protocols
ECE(CSC) 774 - Advanced Network Security
ECE(CSC) 775 - Advanced Topics In Wireless Networking
ECE(CSC) 776 - Design & Performance Evaluation Of Network Systems & Services
ECE(CSC) 777 - Telecommunications Network Design

CPE Online

ECE (CSC) 506 - Architecture of Parallel Computers
ECE (CSC) 517 - Object-Oriented Design and Development
ECE 546 - VLSI Design Systems
ECE 560 - Embedded System Architectures
ECE 561 - Embedded System Optimization
ECE 564 - Asic and Fpga Design with Verilog
ECE (Csc) 570 - Computer Networks
ECE (CSS) 573 - Internet Protocols
ECE (CSC) 574 - Computer and Network Security
ECE (CSC) 575 - Introduction to Wireless Networking
ECE (CSC) 576 - Networking Services: Qos, Signaling, Processes
ECE (CSC, OR) 579 - Introduction to Computer Performance Modeling
ECE 706 - Advanced Parallel Computer Architecture
ECE 720 - Electronic System Level And Physical Design
ECE 745 - Application Specific Integrated Circuit Verification
ECE 773 - Advanced Topics in Internet Protocols
Admission Requirements
Students must meet ONE of the following requirements for admission into the CPE Graduate Certificate Program:

- Have a BS degree in Electrical or Computer Engineering from a regionally accredited four-year college or university, and have an overall GPA of at least 3.0 on a 4-point scale.
- Have a BS degree in the sciences or engineering from a regionally accredited four-year college or university with an overall GPA of at least 3.0 on a 4-point scale.
- Be a degree-seeking student in good standing in an NC State University graduate program in the sciences or engineering.
- Premium tuition is charged on this certificate, students who are currently pursuing other degrees and/or certificates will not be admitted to this certificate until they complete those other programs. Once they are enrolled in this certificate, credit hours will be subject to the Electrical and Computer Engineering MS tuition premium¹, until the certificate is received.

Application and Completion Process
An application for acceptance into the GCP is required for all new students. Students must complete the Graduate School application, found at https://grad.ncsu.edu/apply/.

Those applicants who are currently enrolled in an NC State graduate degree program need only provide the graduate student Certificate Plan Data Entry form, found at https://grad.ncsu.edu/wp-content/uploads/2015/12/grad-cert-plan-data-entry.pdf.

New applications will be reviewed at the department/program level.

Registration procedures, registration dates and course availability for each semester can be found on the NCSU Registration and Records webpage at http://www.ncsu.edu/registrar/. Additional information regarding the EE GCP can be found on the Electrical and Computer Engineering (http://www.ece.ncsu.edu) website. Questions regarding the EE GCP can be directed to the certificate coordinator. Information regarding Engineering Online can be found at http://engineeringonline.ncsu.edu.

Admission to Other Graduate Programs
Academic success in the EE GCP might have a strong bearing on admission to a graduate degree program. However, completion of a graduate certificate program in no way guarantees entry into a graduate degree program, which must be done through a separate application process.

Academic Performance Requirements
- The EE GCP requires a total of 12 credit hours.

¹ Premium tuition is charged based on a student’s program of study, not individual courses the student takes, and this policy is outside the department’s control. For instance, ECE Masters students pay the ECE premium even if in a given semester they take one, two, or three courses outside the ECE department. Similarly, once a student is admitted to the CPE GCP and the certificate is added to their program of study, they will be charged the premium. We plan to include this information on the certificate website so that students make an informed decision.
To receive a Graduate Certificate, a student must maintain a minimum 3.00 grade point average (GPA) on Graduate Certificate coursework taken at NCSU. All grades on courses taken towards the GCP in courses numbered 500 and above are included in the GPA. Any courses taken at the 400 level and below are not eligible for certificate credit.

- All courses taken for certificate credit must be completed with a grade of “B-” or better.
- All courses at the 500- or 700-level taken for certificate credit must be letter-graded. Credit-only courses cannot be used for certificate credit.
- Transfer credit from other institutions is not allowed for the GCP. All coursework must be registered through NC State University.
- Up to three (3) credit hours of NDS coursework, if not already used in another graduate program, may be transferred into the GCP. All transfer credit must carry a grade of B or better.
- Graduate Certificate courses taken by students who are enrolling after completion of a degree program may be double-counted towards that degree (1) to the extent that the courses unique to the degree remain at 18 hours for a Masters degree or 30 hours for a PhD degree and (2) subject to the course requirements of that degree.
- All GCP requirements must be completed within four (4) calendar years, beginning with the date the student commences courses applicable to the GCP. In addition, students must maintain continuous enrollment every semester until all coursework is completed. A one-semester leave of absence may be granted if the student is unable to enroll in a course due to extenuating circumstances. The leave of absence must be approved in writing by the ECE DGP before the start of the semester.

Program Administration
The CPE GCP will be administered by the Director of Graduate Programs in the Department of Electrical and Computer Engineering, in cooperation with the NCSU Engineering Online program for distance-education students.

All certificate courses are existing courses in Electrical and Computer Engineering. The implementation and presentation of the certificate is not expected to require effort outside the normal academic activities of the course instructors. No additional staff or resources are required to support the administration of this program.

Enrollment Projection

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<thead>
<tr>
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<th>Yr 1</th>
<th>Yr 2</th>
<th>Yr 3</th>
<th>Yr 4</th>
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<tr>
<td>Distance</td>
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</table>

These projections are based on (1) discussions with industry members of the Electrical and Computer Engineering Strategic Advisory Board and (2) repeated unsolicited requests and questions received by our program, and take into account the different pace of on-campus vs. online students.
Tuition and Fees
The department will seek approval for a tuition structure that is identical to that of the Electrical and Computer Engineering Masters program, i.e., that includes the tuition premium. Tuition premium is charged based on the student’s program.

Faculty Participants
All faculty who teach graduate-level Computer Engineering courses will participate in the CPE GCP.

Departments likely to be affected
No other departments are likely to be affected by the proposed graduate certificate.

Outcomes Assessment Plan

Objectives

1. The certificate program will provide a graduate level working knowledge of current Computer Engineering concepts and methods.
2. The certificate program will provide an educational experience that satisfies the expectations of its graduates.

Outcomes

1. By the time they complete this certificate program, graduates should be able to:
   - Identify and describe the major principles, methods, and tools of one field of Computer Engineering
   - Apply the methods and tools learned during the certificate studies to tackle computational problems and tasks
   - Use relevant software packages and tools in their own professional activities

2. At the time they complete this certificate program, graduates are expected to:
   - Be satisfied with the usefulness of the certificate program in enabling them to achieve their professional goals
   - Be sufficiently satisfied with the certificate program to recommend it to others with the same professional goals
   - Be satisfied with the appropriateness of the courses in providing the knowledge or training they anticipate needing for their professional goals
   - Be satisfied with the frequency and timeliness of courses offered for the certificate
- Be satisfied with the quality of teaching in certificate courses
- Be satisfied with the overall educational experience of the certificate program

Objective 1. Students will learn advanced concepts, methods and tools of Computer Engineering and apply them to a variety of computational problems tasks.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Evidence to be Collected</th>
<th>Source of Evidence</th>
<th>Frequency of Collection</th>
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</thead>
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<td>Identify and describe the major principles, methods, and tools of one</td>
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<td>Apply the concepts and methods learned during the certificate studies</td>
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<td>to tackle computational problems and tasks</td>
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<tr>
<td>Use relevant software packages and tools in their own professional</td>
<td>Projects in corresponding courses</td>
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Objective 2. The certificate program will provide an educational experience that satisfies the expectations of its graduates

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<td>enabling them to achieve their professional goals</td>
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<td>To be satisfied with the quality of teaching in certificate courses</td>
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<td>To be satisfied with the overall educational experience of the certificate program</td>
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