Graduate Certificate in ASIC Design and Verification
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) 

Date

Recommended By: 

[Signature]

Chair, College Graduate Studies Committee (Printed Name and Signature) 

Date

Endorsed By: 

[Signature]

College Dean (Printed Name and Signature) 

Date

Recommended By: 

[Signature]

Vice Provost, DELTA (if DE degree) (Printed Name and Signature) 

Date

Approved By: 

[Signature]

Dean of the Graduate School (Printed Name and Signature) 

Date

Recommended By: 

[Signature]

Dean’s Council (Printed Name and Signature) 

Date

Approved By: 

[Signature]

Executive Vice Chancellor and Provost (Printed Name and Signature) 

Date

Approved By: 

[Signature]

Chancellor (Printed Name and Signature) 

Date

(revised August 2015)
NC State University
Certificate Proposal Form

Certificate Title: Graduate Certificate in AISC Design and Verification
New: X
Revision: □

Classification of Instructional Programs (CIP) Discipline # (6 digits): 14.1001
*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?v=55

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

Proposed Effective Date: Spring 2020

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 ADV Technologies provides students with advanced academic credentials in the algorithmic, chip, circuit, system and antenna technologies that will underpin ADV Wireless systems.

Enrollment:
<table>
<thead>
<tr>
<th>Continuing</th>
<th>On-Campus</th>
<th>Distance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yr. 1-0</td>
<td>Yr. 1-0</td>
</tr>
<tr>
<td></td>
<td>Yr. 2-3</td>
<td>Yr. 2-5</td>
</tr>
<tr>
<td></td>
<td>Yr. 3-5</td>
<td>Yr. 3-7</td>
</tr>
<tr>
<td></td>
<td>Yr. 4-8</td>
<td>Yr. 4-10</td>
</tr>
<tr>
<td>New</td>
<td>Yr. 1-5</td>
<td>Yr. 1-5</td>
</tr>
<tr>
<td></td>
<td>Yr. 2-7</td>
<td>Yr. 2-5</td>
</tr>
<tr>
<td></td>
<td>Yr. 3-10</td>
<td>Yr. 3-8</td>
</tr>
<tr>
<td></td>
<td>Yr. 4-12</td>
<td>Yr. 4-10</td>
</tr>
</tbody>
</table>

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 ASIC Design and Verification

Program Justification
The Electrical and Computer Engineering (ECE) department proposes to offer a Graduate Certificate Program (GCP) in ASIC Design and Verification (ADV).

ASIC stands for “Application Specific Integrated Circuit”. It refers to a digital silicon chip designed and optimized for a small range of functions. ASIC Design and Verification courses have long been a strong feature of our MS offerings in ECE. Every year over 100 on-campus students and several EOL students take this combination. By creating a Graduate Certificate in this area, we hope to signal to a broader community that NCSU is a market leader in the teaching of these technologies. In addition, there are a number of employers that will pay for their employees to take graduate certificates but not a full MS degree and we hope to capture more of that market.

It will be available to both on-campus students and distance education students through Engineering Online (EOL).

Program Objectives
1. In this certificate program, students will learn advanced concepts, methods and tools underlying the design and verification of digital ASICs.
2. The certificate program will provide an educational experience that satisfies the expectations of its graduates.

Program of Study
The ADV GCP requires a total of 12 credit hours consisting of four graduate-level Electrical and Computer Engineering courses taken for a letter grade. (EOL = course offered via EOL as well to residential students)

I. All students must complete the following four courses:
   - ECE 564 ASIC and FPGA Design with Verilog (EOL)
   - ECE 745 ASIC Verification (EOL)
   - ECE 748 ASIC Verification with Universal Verification Methodology (EOL)
   - ECE 546 VLSI Design (EOL) or ECE 720 Electronic System Level and Physical Design (EOL)

Note, ECE 720 and ECE 745 require ECE 564. ECE 748 requires ECE 745. All these courses are offered every year. All these courses have required projects.

Admission Requirements
Students must meet ONE of the following requirements for admission into the ADV 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 or a BA 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. The student needs to have taken and passed the background courses appropriate for their proposed plan of study. The requirements will be the same as for an MS student as per our application website https://www.ece.ncsu.edu/grad/apply/

• 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 premium\(^1\), 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 ADV GCP can be found on the Electrical and Computer Engineering (http://www.ece.ncsu.edu) website. Questions regarding the ADV 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 ADV 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 ADV GCP requires a total of 12 credit hours.

• 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.

---

\(^1\) 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 ADV 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.
• 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 NOS 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 36 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 ADV 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
On campus Yr 1 5 Yr 2 10 Yr 3 15 Yr 4 20
Distance Education Yr 1 5 Yr 2 10 Yr 3 15 Yr 4 20

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 taking 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 Master’s program, i.e., that includes the tuition premium. Tuition premium is charged based on the student’s program.

Faculty Participants
All faculty who teach courses listed in the Certificate will participate in the ADV GCP.
Departments likely to be affected

No other department is affected.

Outcomes Assessment Plan

Objectives

1. In this certificate program, students will learn advanced concepts, methods and tools underlying the design and verification of digital ASICs.
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:
   - Apply the methods and tools learned during the certificate studies to tackle ADV problems and tasks
   - Use relevant software packages and tools to tackle ADV problems and tasks
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 will be measured by having students upload class project reports to a specially constructed Moodle or similar site. A sample of these will be evaluated against the following rubric:

- To what extent do the project reports demonstrate that students learned to apply concepts, methods and tools to tackle ADV problems and tasks? (1=Not at all, 5=high).
- To what extent do the project reports demonstrate that students learned relevant software packages to tackle ADV problems and tasks? (1=Not at all, 5=high).

Objective 2 will measure student satisfaction of their experience in the certificate by questions on the Graduate School’s graduating student exit survey.
Objective 1. Students will learn advanced concepts, methods and tools underlying the design and verification of digital ASICs.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Evidence to be Collected</th>
<th>Source of Evidence</th>
<th>Frequency of Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply the concepts, methods, and tools learned during the certificate studies to tackle ADV problems and tasks</td>
<td>Student project reports</td>
<td>Uploaded project reports</td>
<td>Bi-Annually</td>
</tr>
<tr>
<td>Use relevant software packages to tackle ADV problems and tasks</td>
<td>Student project reports</td>
<td>Uploaded project reports</td>
<td>Bi-Annually</td>
</tr>
</tbody>
</table>

Note: Each of the certificate courses have a required class.

Objective 2. The certificate program will provide an educational experience that satisfies the expectations of its graduates.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Evidence to be Collected</th>
<th>Source of Evidence</th>
<th>Frequency of Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be satisfied with the usefulness of the certificate program in enabling them to achieve their professional goals</td>
<td>Exit survey administered by Graduate School</td>
<td>Graduate School</td>
<td>Bi-Annually</td>
</tr>
<tr>
<td>To be sufficiently satisfied with the certificate program to recommend it to others with the same professional goals</td>
<td>Exit survey administered by Graduate School</td>
<td>Graduate School</td>
<td>Bi-Annually</td>
</tr>
<tr>
<td>To be satisfied with the appropriateness of the courses in providing the knowledge or training they anticipate needing for their professional goals</td>
<td>Exit survey administered by Graduate School</td>
<td>Graduate School</td>
<td>Bi-Annually</td>
</tr>
<tr>
<td>To be satisfied with the frequency and</td>
<td>Exit survey administered by Graduate School</td>
<td>Graduate School</td>
<td>Bi-Annually</td>
</tr>
<tr>
<td>Timeliness of Courses Offered for the Certificate</td>
<td>Exit Survey Administered by Graduate School</td>
<td>Graduate School</td>
<td>Bi-Annually</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>------------------------------------------</td>
<td>----------------</td>
<td>------------</td>
</tr>
<tr>
<td>To be satisfied with the quality of teaching in certificate courses</td>
<td>Exit Survey administered by Graduate School</td>
<td>Graduate School</td>
<td>Bi-Annually</td>
</tr>
<tr>
<td>To be satisfied with the overall educational experience of the certificate program</td>
<td>Exit Survey administered by Graduate School</td>
<td>Graduate School</td>
<td>Bi-Annually</td>
</tr>
</tbody>
</table>