Date: __22 January 2015______

Subject: __New Course Proposal for ECGR 4190__________

Originating Department: __ECE____________________

**TYPE OF PROPOSAL:** UNDERGRADUATE _X_  GRADUATE  UNDERGRADUATE & GRADUATE  
(Separate proposals sent to UCCC and Grad. Council)

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<th>DATE RECEIVED</th>
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<th>COMMENTS: APPROVED, APPROVED WITH REVISIONS, ETC.</th>
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<td>GRADUATE COUNCIL CHAIR (for graduate courses only)</td>
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<td>FACULTY GOVERNANCE ASSISTANT</td>
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Revised 05/06/14
OAA/mjw
*To: Dr. Mehdi Miri

From: Dr. Ryan Adams

Date: 22 January 2015

Re: New Course Proposal for ECGR 4190

**SUMMARY:**

The Electrical and computer Engineering Department proposes to add a new course, ECGR 4190, Science and Technology of Photovoltaics. This class will enhance the department offerings in renewable energy, a major new area of focus for the department. The class will consist of two lectures each week in which students will learn the design and modeling of high efficiency solar cells on various semiconductor materials. The economics of various solar cell structures and systems would be covered including the localized cost of electricity (LCOE) to compare in real terms, the cost of electricity from solar, to other sources of energy. This will be a 3 credit class.

**FOR CONSULTATION WITH OTHER DEPARTMENTS:**

1. Does the proposed change affect other departments (including additions and/or changes to degree requirements or prerequisites offered in other departments)?
   _______Yes   ___X___ No

2. If Yes, please list the other departments affected by the proposed change:

3. Have you consulted with each department listed in item 2 regarding the proposed change?

Revised 05/06/14
OAA/mjw
Yes  No

Result(s) of Consultation(s) (please attach documentation):

4. For a new course or for major modification of an existing course, include Consultation on Library Holdings.

5. For proposals involving Honors courses or programs, include written consultation with the Honors Council.

RESOURCES:
1. For a new course or revisions to an existing course, check all the statements that apply:
   ___ This course will be cross listed with another course.
   ___ There are prerequisites for this course.
   ___ There are co-requisites for this course.
   ___ This course is repeatable for credit.
   ___ This course will affect the number of credits hours for its program.
   ___ This proposal results in the deletion of an existing course(s) from the degree program and/or catalog.
   ___ This proposal will alter an agreement with a North Carolina community college.

For all items checked above, applicable statements and content must be reflected in the proposed catalog copy.

2. Indicate the additional resources required, if any, to implement and maintain the proposed change.

None

CREDIT HOUR (Mandatory if new and/or revised course in proposal):
Review statement and check box once completed.

☒ The appropriate faculty committee has reviewed the course outline/syllabus and has determined that the assignments are sufficient to meet the University definition of a credit hour.

PROPOSED CATALOG COPY: For existing courses copy and paste the current catalog copy and use the Microsoft Word “track changes” feature (or use red text with “strike through” formatting for text to be deleted, and adding blue text with “underline” formatting for text to be added). For new courses, draft comprehensive catalog copy.

ECGR 4190. Science and Technology of Photovoltaics. (3) Prerequisite: ECGR 3133 with a grade of C or above, or permission of the department. Review of semiconductor properties; junctions and operating principles of solar cells; efficiency limits and losses in solar cells; solar cells and sunlight; fabrication of solar cell and modules; design of high efficiency silicon solar cells; heterojunction, thin film and other promising solar cells; photovoltaic systems and applications.

ACADEMIC PLAN OF STUDY (UNDERGRADUATE ONLY): Does the proposed change impact an existing Academic Plan of Study?
Yes. If yes, please provide updated Academic Plan of Study in template format.

☐ No.

**STUDENT LEARNING OUTCOMES (UNDERGRADUATE & GRADUATE):** Does this course or curricular change require a change in SLOs or assessment for the degree program?

☐ Yes. If yes, please provide updated SLOs in template format.

☒ No.

**TEXTBOOK COSTS:** It is the policy of the Board of Governors to reduce textbook costs for students whenever possible. Have electronic textbooks, textbook rentals, or the buyback program been considered and adopted?

☒ Yes. Briefly explain below.

☐ No. Briefly explain below.

A freely available electronic text has been adopted for this course.

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**IMPORTANT NOTE:** A Microsoft Word version of the final course and curriculum proposal should be sent to facultygovernance@uncc.edu upon approval by the Undergraduate Course and Curriculum Committee and/or Graduate Council chair.
Consultation on Library Holdings

To: Aba Ebong
From: Jeff McAdams
Date: 10/20/14
Subject: ECGR 4190 – Photovoltaic Science and Engineering

Summary of Librarian’s Evaluation of Holdings:
Evaluator: Jeff McAdams Date: 10/20/14

Check One:
1. Holdings are superior
2. Holdings are adequate
3. Holdings are adequate only if Dept. purchases additional items.
4. Holdings are inadequate

Comments:
Library holdings should be adequate to support student research for this course (see list of items held by subject heading below). Students will have access to relevant databases including Inspec, Compendex, Science Direct, IEEE Xplore, ENGnetBASE, Electronics & Communications Abstracts, Solid State and Superconductivity Abstracts, Optics InfoBase, Web of Science, and many others.

<table>
<thead>
<tr>
<th>LC Subject Heading</th>
<th>Books</th>
<th>Journals</th>
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<tbody>
<tr>
<td>Solar Cells</td>
<td>420</td>
<td>2</td>
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<td>Photovoltaic</td>
<td>340</td>
<td>15</td>
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<td>Solar energy storage</td>
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<td>8</td>
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<td>Semiconductors</td>
<td>1315</td>
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Evaluator’s Signature

10/20/14

Date
Textbooks

Course Objectives
To introduce the science, technology and operating principles of various solar cells, including optoelectronic properties of bulk and thin film silicon, and solar cell fabrication and characterization of solar cells. Module, laboratory, and design factors for high efficiency solar cells, compound semiconductors, modeling and design factors for high efficiency solar cells, including optoelectronic properties of bulk and thin film silicon, and solar cell fabrication and characterization of solar cells.

Course Website
Moodle.unc.edu
Epic 2230

Office Hours
Tuesdays: 10:00-12:00 am and appointments

Office: Epic 2162
Dr. ABA Etong
Office Hours

Venue
Class Hour
Spring 2014

Course website

UNC CHAPEL HILL

Science & Technology of Photovoltaic
ECGR 4090/5090
Must be turned off during class meetings.

**Cell Phones**

None of the above is allowed by the University during regular class meetings.

**Smoking, eating, and drinking during classes**

You are responsible for all topics, assignments, and announcements.

**Attendance**

- Final Exam: 40%
- Homework: 10%
- Project: 30%
- Quizzes: 10%
- Tests: 10%

**Final Grades will be based on the following exams and grades**
1. Solar Cells and Sunlight

Syllabus
5. Fabrication of solar cell and modules
   a. Promising PV Si materials
   b. Fabrication of baseline Si solar cell
   c. Fabrication of advanced Si solar cells
   d. Construction of solar cell module
6. Design of high efficiency Si Solar Cells
   a. Surface recombination velocity & spectral response consideration
   b. Heavy doping effects, junction depth, emitter doping profile consideration
   c. Substrate doping, thickness & diffused length consideration
   d. Grid, BSF, ARC designs
   e. Texturing & Light trapping
7. Heterojunction, thin film & other promising solar cells
   a. GaAs solar cells
   b. Amorphous Si thin-film solar cells
   c. Polycrystalline thin-film CdTe & CuInSe₂ cells
   d. Multi junction solar cells
   e. Concentrator solar cells
   f. Organic solar cells
8. PV Systems & applications
   a. Stand alone PV systems
   b. Utility interactive PV systems
   c. Modeling & design of PV systems
   d. Building integrated PV
become aware of the course instructor, who is responsible for dealing with them. Integrity will be enforced in this course. Students are expected to report cases of academic dishonesty. Students Office on campus is 103 HML. Students who violate the code may be punished to the extent of being permanently expelled from UNC-Chapel Hill. If you do not have a copy of the Code, you can obtain one from the Dean of Students. The normal penalty is zero credit on the work involving dishonesty and further substantial reduction of the course grade. In almost all cases, the course grade is reduced to "F." If you do not have a copy of the Code, you can obtain one from the Dean of Students Office online at www.unc.edu/ethicalpolicies. Standards of academic honesty are set forth in the Code of Student Academic Integrity. The UNCG Orientation and Academic Integrity (see the Catalog). This Code forbids cheating. All UNCG students must have the responsibility to be familiar with and to observe the requirements of the Code. Foreign students may be required to take the quizzes and exams, while they are not required to take the quizzes and exams. Please read the discourse on cheating and ECR 4090/5090 on the Web page. For homework and assignments, you must submit your work on time. The instructor will be notified if your signature is not received, or if you do not submit assignments on time. Under the circumstances, you may be asked to submit an essay or an assignment that you have written. This essay or assignment is not required to be submitted. In addition, it is my understanding that you must sign your name on any test or assignment that you will not have given. The provisions of the University code of academic integrity apply to this course. In addition, it is my
sexual orientation, and socioeconomic status.

is not limited to ability/disability, age, culture, ethnicity, gender, language, race, religion, individuals is respected and maintained. Therefore, we celebrate diversity that includes, but
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Diversity: UNC Charlotte strives to create an academic climate in which the dignity of all

process and inform me during the first two weeks of class.
follow the instructions of that office for obtaining accommodations. Please initiate this
accommodations to disabilities must first consult with the Office of Disability Services and
services can be found at: hhp://www.uncc.edu/DSS. Students in this course seeking
building, Room 230. Phone 704/687.4355 (voice/TTY). Information about available
accommodation in this course, contact the Disability Services office (located in Freeman
accommodation in this course, contact the Disability Services office (located in Freeman

Disability Services/Special Needs: If you have a documented disability and require
announcement in class and/or by email to your UNCC email address. 

Syllabus Revisions: The standards and requirements set forth in this syllabus may be 

Instructor and Student Conduct

Refer to the web page: hhp://www.registrar.uncc.edu/calendars.htm for the academic

Course Calendar
specific details and the form. Read the policy webpage for hardship.

Academic calendar: A student who submits a request for Religious Accommodation Form for each semester (especially the length of instruction) can be found in UNC Charlotte's Academic Calendar. The census date for each semester (typically the first day of instruction) is used. The census date when instructors prior to the census date for enrollment for a given semester. The religious accommodation request for Religious Accommodation Form to which they will be assigned by submitting a Request for Religious Accommodation Form to students to provide faculty with reasonable notice of the dates of religious observances
students to provide faculty with reasonable notice of the dates of religious observances.

Religious accommodations because of a religious practice or belief must be provided with a reasonable accommodation. In accordance with this Policy, students, examining committees, or other faculty members may request an accommodation. For Religious Accommodations for Students: UNC Charlotte Policy #134 in part states:

Committe of Academic Communication systems, including course-based chat rooms, or misceage.

Charlote Sexual Harassment Policy is prohibited, even when carried out through computers.

https://www.unc.edu/policies/ps66.html Sexual Harassment, as defined in the UNC Responsible Use of University Computing and Electronic Communication Resources (Policy) (https://www.unc.edu/policies/ps66.html) and the policy on Sexual Harassment: All students are required to abide by the UNC Charlotte Sexual Harassment Policy.