

# 2014-2015 LONG SIGNATURE SHEET



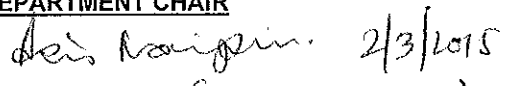
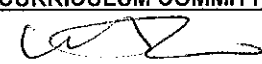
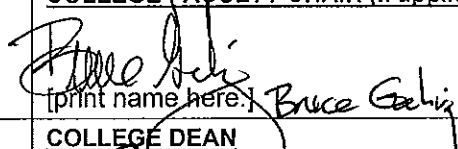
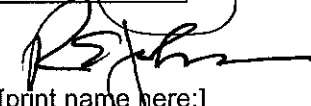
UNC CHARLOTTE

Proposal Number: ECGR 1-23-15

Proposal Title: Proposal for new course ECGR 6173/8173 Power Quality

Originating Department: Electrical and Computer Engineering

TYPE OF PROPOSAL: UNDERGRADUATE \_\_\_\_\_ GRADUATE X UNDERGRADUATE & GRADUATE \_\_\_\_\_  
 (Separate proposals sent to UCCC and Grad. Council)

DATE RECEIVED	DATE CONSIDERED	DATE FORWARDED	ACTION	SIGNATURES
			Approved	<u>DEPARTMENT CHAIR</u>  [print name here: (ASIS NASIPURI)]
			Approved	<u>COLLEGE CURRICULUM COMMITTEE CHAIR</u>  [print name here:] TAO HONG
			Approved	<u>COLLEGE FACULTY CHAIR (if applicable)</u>  [print name here:] Bruce Gehrig
	9/21/15		Approved	<u>COLLEGE DEAN</u>  [print name here:]
			Approved	<u>GENERAL EDUCATION</u> (if applicable; for General Education courses) [print name here:]
			Approved	<u>HONORS COLLEGE</u> (if applicable; for Honors courses & programs) [print name here:]
			Approved	<u>UNDERGRADUATE COURSE &amp; CURRICULUM COMMITTEE CHAIR (for undergraduate content)</u>
			Approved	<u>GRADUATE COUNCIL CHAIR</u> (for graduate content)
				<u>FACULTY GOVERNANCE ASSISTANT</u> (Faculty Council approval on Consent Calendar)
				<u>FACULTY EXECUTIVE COMMITTEE</u> (if decision is appealed)



# UNC CHARLOTTE

## LONG FORM COURSE AND CURRICULUM PROPOSAL

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\*To: Chair of the Graduate Council

From: Badrul H. Chowdhury, ECE

Date: January 23, 2015

Re: Proposal for new course ECGR 6173/8173 Power Quality

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The Long Form is used for major curriculum changes. Examples of major changes can include:

**Undergraduate:** Major changes include new undergraduate degrees, minors, concentrations, certificates, and changes to more than 50% of an existing program (Note: changing the name of an academic department does not automatically change the name(s) of the degree(s). The requests must be approved separately by the Board of Governors.)

**Graduate:** Major changes include new graduate courses, major changes to an existing graduate course or major changes to an existing graduate program

Submission of this Long Form indicates review and assessment of the proposed curriculum changes at the department and collegiate level either separately or as part of ongoing assessment efforts.

\*Proposals for undergraduate courses and programs should be sent to the Undergraduate Course and Curriculum Committee Chair. Proposals related to both undergraduate and graduate courses,

(e.g., courses co-listed at both levels) must be sent to both the Undergraduate Course and Curriculum Committee and the Graduate Council.

ECGR 1-23-15

University of North Carolina at Charlotte

Proposal for New Graduate Course

Course and Curriculum Proposal from: Department of Electrical and Computer Engineering

Title: *Proposal for new course ECGR 6173/8173 Power Quality*

## II. CONTENT OF PROPOSALS

### A. PROPOSAL SUMMARY AND CATALOG COPY

1. **SUMMARY:** The Electrical and Computer Engineering Department proposes to add a new elective course to the graduate curriculum:
  - ECGR 6173/8173: Power Quality

2. **PROPOSED CATALOG COPY:**

**ECGR 6173. Power Quality. (3)** Prerequisite: ECGR 4141/5193 Power Systems Analysis I, or equivalent. Definitions of power quality, types of power quality problems; sources of sags, transient overvoltages and harmonics; distribution overcurrent protection methods and their effect on power quality and reliability; harmonic analysis, principles of controlling harmonics, devices for filtering harmonics; power quality improvement methods. Credit will not be given for ECGR 6173 where credit has been given for ECGR 8173. (*Fall*).

**ECGR 8173. Power Quality. (3)** See ECGR 6173 for course description. Credit will not be given for ECGR 8173 where credit has been given for ECGR 6173.

### B. JUSTIFICATION

1. Identify the need addressed by the proposal and explain how the proposed action meets the need: In recent years, because of the drive for increased energy efficiency, and the proliferation of power electronics-enabled distributed energy resources, there has been a

tremendous interest in the quality of power delivered to the customer. Concurrently, the power distribution grid is undergoing a paradigm shift of sorts in that smart grid technologies are allowing the use of the distribution system in a manner that it was not designed to function, for example reverse power flows. This, coupled with the traditional protection and coordination functions are leading to voltage sags/swells, transients and harmonics. This course discusses these phenomena in detail and offers solution techniques for these problems. This course is offered both at the MS and PhD levels.

Specific goals are for the students are to:

- a) Have a working knowledge of the various forms of power quality issues in the power industry
  - b) Understand the impact of poor power quality
  - c) Understand the relationship between reliability and power quality.
  - d) Understand the solution techniques for improving power quality
2. Discuss prerequisites/corequisites for course(s) including class-standing: Prerequisite: ECGR 4141/5193 Power Systems Analysis I, or equivalent.
  3. Demonstrate that course numbering is consistent with the level of academic advancement of students for whom it is intended: The course numberings ECGR 6173/8173 is consistent with the level of academic advancement of graduate students, for whom these courses are intended.
  4. In general, how will this proposal improve the scope, quality and/or efficiency of programs and/or instruction: This course is suitable for graduate students intending to specialize in the power systems area in the ECE Department at UNCC. This course can effectively help educate students to be cognizant of the challenges we face in power delivery, and also prepare them for advanced research in the field of power and energy.
  5. If course(s) has been offered previously under special topics numbers, give details of experience including number of times taught and enrollment figures.
    - ECGR 5090 Special Topics: Power Systems
      - Fall 2014, Enrollment: 9 (2 MS; 7 PhD)

### C. IMPACT

1. What group(s) of students will be served by this proposal? This course will serve all graduate students in electrical and computer engineering irrespective of whether they are enrolled in the power area. This course will be especially useful though for students taking the concentration in power systems.

2. What effect will this proposal have on existing courses and curricula? The proposed course will complement the existing courses in power and energy systems in the ECE Department.

- a. When and how often will added course(s) be taught? According to the current demand and scheduling of courses, ECGR 6173/8173 will be taught each Fall.
- b. How will the content and/or frequency of offering of other courses be affected? None expected.
- c. What is the anticipated enrollment in course(s) added (for credit and auditors)? Typical enrollment is expected to be 10~15 ECE graduate students. This is consistent with current offerings of the equivalent special topics course.
- d. How will enrollment in other courses be affected? None to minimal expected.

How did you determine this? This course has been offered three times already as a special topics course and none of the other elective courses in the power area were impacted. It is clear that this course fills a niche requirement.

- e. Identify other areas of catalog copy that would be affected, e.g., curriculum outlines, requirements for the degree, etc. Cross-listing ECGR 6173 with ECGR 8173.

### III. RESOURCES REQUIRED TO SUPPORT PROPOSAL

**a. Personnel**

- a. Specify requirements for new faculty, part-time teaching, student assistant and/or increased load on present faculty: None. The course sequence will be taught by one faculty member at no required increased teaching load and with no teaching assistant.
- b. List by name qualified faculty members interested in teaching the course(s): Dr. Badrul Chowdhury only has taught this course before as a special topics course, but Dr. Johan Enslin, Dr. Sukumar Kamalasan, and Dr. Madhav Manjrekar are also qualified faculty members interested in teaching this course.

**b. Physical Facility: None**

**c. Equipment and Supplies: None**

**d. Computer: None**

e. **Audio-Visual:** None

f. **Other Resources:** None

g. **Source of Funding.** Indicate source(s) of funding for new/additional resources required to support this proposal: None required

#### **4. CONSULTATION WITH THE LIBRARY AND OTHER DEPARTMENTS OR UNITS**

1. Library Consultation

Indicate written consultation with the Library Reference Staff at the departmental level to insure that library holdings are adequate to support the proposal prior to its leaving the department. (Attach copy of *Consultation on Library Holdings*).

2. Consultation with other departments or units  
None

3. Honors Council Consultation. In the case of Honors courses or Honors programs indicate written consultation with the Honors Council (if applicable). None

#### **5. INITIATION AND CONSIDERATION OF THE PROPOSAL**

1. Originating Unit

Approved per attached signatures

2. Other Considering Units  
None

3. **CREDIT HOUR. (Mandatory if new and/or revised course in proposal):** 3

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.

A. ATTACHMENTS.

1. CONSULTATION: Attach relevant documentation of consultations with other units.
2. COURSE OUTLINE/SYLLABUS: For undergraduate courses attach course outline(s) including basic topics to be covered and suggested textbooks and reference materials with dates of publication. For Graduate Courses attach a course syllabus. Please see Boiler Plate for Syllabi for New/Revised Graduate Courses.
3. PROPOSED CATALOG COPY: Copy should be provided for all courses in the proposal. Include current subject prefixes and course numbers, full titles, credit hours, prerequisites and/or corequisites, concise descriptions, and an indication of when the courses are to be offered as to semesters and day/evening/weekend. Copy and paste the current catalog copy and use the Microsoft Word "track changes" feature (or use red text with "strikethrough" formatting for text to be deleted, and adding blue text with "underline" formatting for text to be added).

a. 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 corequisites for this course.
- This course is repeatable for credit.
- This course will increase/decrease the number of credits hours currently offered by its program.
- This proposal results in the deletion of an existing course(s) from the degree program and/or catalog.

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

b. If overall proposal is for a new degree program that requires approval from General Administration, please contact the [facultygovernance@uncc.edu](mailto:facultygovernance@uncc.edu) for consultation on catalog copy.

4. 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.
5. STUDENT LEARNING OUTCOMES (UNDERGRADUATE & GRADUATE): Does this course or curricular change require a change in Student Learning Outcomes (SLOs) or assessment for the degree program?

- Yes. If yes, please provide updated SLOs in template format.  
 No.

6. 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.

*Electronic version of the textbook was not available at the time it was adopted. However, the cost of the textbook (about \$40) is well below average and rentals and buybacks are available at the bookstore.*

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



# THE UNIVERSITY OF NORTH CAROLINA AT CHARLOTTE

The William States Lee College of Engineering

## ECGR 6090/ECGR 8090 Power Quality

**Room:** EPIC 1249

**Time:** T, Th: 3:30 – 4:45 pm

### Course Description:

Definitions of power quality, types of power quality problems; sources of sags, transient overvoltages and harmonics; distribution overcurrent protection methods and their effect on power quality and reliability; harmonic analysis, principles of controlling harmonics, devices for filtering harmonics; power quality improvement methods.

**Instructor:** Prof. Badrul H Chowdhury

**Phone:** (704) 687-1960

**Fax:** (704) 687-5588

**E-mail:** b.chowdhury@uncc.edu

**Office:** EPIC 1162    **Office Hours:** M and Tu: 11 am – noon

**Prerequisite:** ECGR 4141/5193 Power Systems Analysis I, or equivalent.

### Required Textbook

Fundamentals of Electric Power Quality, by Surya Santoso.

Publication Date: December 23, 2010

ISBN/EAN13: 144049102X / 9781440491023

Publisher: Createspace (<https://www.createspace.com/3362758>)

### Reference Textbooks

1. Electric Power Quality, by G.T. Heydt. Stars in a circle publications. 1991.
2. M. Bollen, Understanding Power Quality Problems, IEEE Press, 1999.

**Supplementary Materials:** Lecture notes will be provided through the course web-site on Moodle.

### Learning Objectives:

After completing the course, the students will be able to

1. Have a working knowledge of the various forms of power quality issues in the power industry
2. Understand the impact of poor power quality
3. Understand the relationship between reliability and power quality.
4. Understand the solution techniques for improving power quality

## Course Outline: (Tentative)

Topic	# Lectures
1. Introduction (Chapter 1 and Instructor notes)	2
2. Definitions (Chapter 2)	1
3. Voltage sag analysis and mitigation (Chapter 3 and part of Chapter 4)	6
4. Distribution system analysis and protection (Instructor notes)	6
5. Voltage surge analysis and mitigation (Chapter 5 and Instructor notes)	8
6. Harmonic distortion (Chapter 6 and Instructor notes)	8
7. Principles of controlling harmonics (Chapter 7 and Instructor notes)	2
8. Long duration voltage variations (Instructor notes)	2
9. Grounding (Instructor notes)	1
10. Review	1

## Course Policies, Requirements and Assessment:

1. **Exams:** There will be two exams and the final during the semester.
2. **Excused absence:** A medical certificate will be required to make up a test because of absence from a test due to illness. For absences from tests or quizzes because of plant trips, you will need to provide some documentation or proof, 24 hours in advance, that you will be going on a plant trip. Usually a travel itinerary from the company or a copy of the ticket is sufficient.
3. **Homework** is due in class on the second class period after the assigned date unless otherwise announced. For some assignments, students will be working in groups, but Individual Assignments should be completed independently. Students who plagiarize from other sources or hand in assignments identical to or copied from others (except for assignments submitted as a group) will be violating scholastic honesty regulations and will not receive credit and will be subject to university's procedures and policies! You must submit all work in class before class begins on the date the homework is due. If you wish to submit your work early, you may certainly do so in person. On occasion, you will be allowed to upload your homework to Moodle. In those cases, you must name you file '**HW#\_Lastname\_Firstname**' where # is replaced by the assignment number, Lastname and Firstname are your last and first names. You must also scan into a pdf document before uploading the assignment.
4. **Term project:** Students will work individually, or in teams on an applied or theoretical project topic related to power quality. Each team will write a proposal and a final report and present their work. Specific interests of students related to their job or research work will also be taken into account.
5. If you wish to discuss the grade received on homework/tests, you will have 4 weeks from the date of the homework submission or the date of the test to do so. After that, no change will be made on the grade. You will have a full semester after the date of the final exam to ask to see the final. However, the review must be done in person.

6. You are encouraged to visit with me during office hours. If you have a conflict with my posted hours, please call for an appointment. Email exchanges are always encouraged.

### **Moodle Environment**

This course includes a significant and required use of the Moodle on-line environment. You must be able to access course materials and announcements on-line. You can login to Moodle here: <https://moodle2.uncc.edu/login/index.php>

### **Diversity**

The William Lee States College of Engineering strive to create an inclusive academic climate in which the dignity of all individuals is respected and maintained. Therefore, we celebrate diversity that includes, but is not limited to ability/disability, age, culture, ethnicity, gender, language, race, religion, sexual orientation, and socio-economic status.

### **Academic Honesty**

You are required to complete 100% of your own work in this class (including making a full contribution to the team project). Cheating violates the UNC Charlotte Code of Academic Integrity and may result in course failure, suspension, and/or expulsion. For more information see the following: <http://integrity.uncc.edu/>

### **Disability and Impairment Accommodation**

If you require course adaptations or accommodations because of a disability, or if you have emergency medical information about which we should be informed, please speak with us as soon as possible. Students who require such accommodations must work with the Office of Disability Services (704-687-4355).

#### **□ Grading Policy:**

Exam I	20%
Exam II	20%
Final Exam	30%
Term Project and Presentation	15%
Homework	15%

The grading scale is as follows:

A = 90 -100      B = 80 - 89.99      C = 70 - 79.99      U = < 70