

**Rutgers University, Department of Electrical and Computer Engineering**  
**ABET COURSE SYLLABUS**  
**COURSE: 14:332:428**

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| <b>Course Catalog Description:</b>       | 14:332:428 Capstone Design – Communications Systems (3)<br>Capstone design experience in communications systems engineering. The course focuses on team-oriented projects involving practical analog, digital communications systems, as well as wireless communications systems. In addition to already amassed theoretical knowledge, projects require application of realistic engineering constraints such as manufacturability and economics, as well as issues dealing with safety and ethics.   |
| <b>Pre-Requisite Courses:</b>            | 14:332:427 or 14:332:421   |
| <b>Co-Requisite Courses:</b>             | None   |
| <b>Pre-Requisite by Topic:</b>           | Fundamentals of communications systems analysis and design.  |
| <b>Textbook &amp; Materials:</b>         | P. H. Young, P. H., <i>Electronic Communication Techniques</i> , Fifth Edition, Prentice Hall, 2004.<br><br>C. W. Sayre, <i>Complete Wireless Design</i> , McGraw-Hill, 2001.<br><br>A. Goldsmith, <i>Wireless Communications</i> , Cambridge University Press, 2006.<br><br>J. G. Proakis, M. Salehi and G. Bauch, <i>Contemporary Communication Systems Using MATLAB and Simulink</i> , Thomson Engineering, 2004.   |
| <b>References:</b>                       | Technical literature from industry, journals and Internet.   |
| <b>Overall Educational Objective:</b>    | Learn how to design and implement communication systems.   |
| <b>Course Learning Outcomes:</b>         | A student who successfully fulfills the course requirements will have demonstrated:<br><br><ol style="list-style-type: none"><li>1. An ability to design a system or process to meet given specifications with realistic engineering constraints.</li><li>2. An ability to function as a member of an engineering design team.</li><li>3. An ability to utilize technical resources both from prior relevant coursework, as well as from sources students must seek out on their own (e.g., various technical literature, data sheets, webinars, etc.)</li><li>4. An ability to write technical documents and give oral presentations related to design project results.</li></ol> |
| <b>How Course Outcomes are Assessed:</b> | Project proposal (20%)   |

Design review reports and presentations (30%)

Final design project report (25%)

Final design project oral presentation (25%)

**N = None    S = Supportive    H = Highly related**

| <b>Outcome</b>   | <b>Level</b> | <b>Proficiency assessed by</b>  |
|--|--------------|---|
| (a) an ability to apply knowledge of Mathematics, science, and engineering   | H            | Design experience and final report  |
| (b) an ability to design and conduct experiments and interpret data  | H            | Design experience and final report  |
| (c) an ability to design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability | H            | Design experience and final report  |
| (d) an ability to function as part of a multi-disciplinary team  | H            | Team effort in the design process   |
| (e) an ability to identify, formulate, and solve ECE problems  | H            | Design experience and final report  |
| (f) an understanding of professional and ethical responsibility  | S            | Research related to design process  |
| (g) an ability to communicate in written and oral form   | H            | Writing technical reports and giving oral presentations                                     |
| (h) the broad education necessary to understand the impact of electrical and computer engineering solutions in a global, economic, environmental, and societal context   | S            | Research in the design process related to motivation and dealing with realistic constraints |
| (i) a recognition of the need for, and an ability to engage in life-long learning  | H            | Research related to design process  |
| (j) a knowledge of contemporary issues   | S            | Relevance of the design project   |
| (k) an ability to use the techniques, skills, and modern engineering tools necessary for electrical and computer engineering practice  | H            | Design experience and final report  |
| Basic disciplines in Electrical Engineering  | H            | Design experience and final report  |
| Depth in Electrical Engineering  | H            | Design experience and final report  |
| Basic disciplines in Computer Engineering  | S            | Design experience and final report  |
| Depth in Computer Engineering  | N            |   |
| Laboratory equipment and software tools  | H            | Design experience   |
| Variety of instruction formats   | S            | Lab and Office Hour discussions, student presentations                                      |

#### **Course description:**

This capstone design course consists of open-ended design projects that incorporate fundamental and advanced concepts of communications systems. The focus of the design projects is the implementation of analog, digital communications systems, as well as wireless communications systems, though the area is broad enough to cover a variety of fixed network communications issues including but not limited to the modern Internet. Measurement and/or characterization of system performance is performed so as to demonstrate that the design objectives and specifications have been met. Design projects are accomplished through team effort with teams comprised of two to six students. The final design project reports must address issues, as appropriate, that are related to manufacturability, engineering economics, environmental, social, as well as health and safety. As an ongoing part of the process, the design team must prepare and deliver oral presentations describing their design process and results. The objective of this course is to provide a comprehensive capstone design experience for students in a team-oriented format that is consistent with ABET requirements.

The course structure consists of weekly meetings throughout the semester with students that have been organized into design teams. Faculty participation in the design process involves mentoring and oversight in the following areas:

- (1) guide students as they proceed with their project designs
- (2) monitor the progress of project designs
- (3) expose the students to various economic, ethical, and social effects related to their design projects
- (4) present methods of writing technical reports and interact with students to enhance their writing skills
- (5) assess the quality of presentation describing the team final design project results

At the conclusion of each design project the design team is required to submit a written technical report describing the details of the final design process and results, as well as highlight relevant conclusions. At the end of the semester each design team is required to prepare and deliver publicly (especially to the class as a whole) an oral presentation describing the final design project.

**Computer Usage:** Simulations using CAD software packages, control software design. Technical reports and presentations are prepared using word processing and graphics software.

**Laboratory Experiences:** Extensive laboratory experience will usually be required to achieve design project results, although the “laboratory” may also include vetting algorithms numerically via simulation.

**Design Experiences:** This is a capstone design course. The entire course is devoted to the solution of an open-ended engineering design project that is to meet stated specifications.

**Independent Learning Experiences:**

1. Extensive research to complete open-ended design as needed.
2. Formulate experiments and collect data to verify design steps.
3. Write technical reports.
4. Prepare and deliver oral presentations relating to the design process.

**Contribution to the Professional Component:**

(a) College-level mathematics and basic sciences: 0 credit hours

(b) Engineering Topics (Science and/or Design): 3 credit hours

(c) General Education: 0 credit hours

Total credits: 3

**Prepared by:** D. Daut and C Rose

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