

# Rose-Hulman Institute of Technology Course Catalog

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<a href="#">Consulting Engineering Program Certificate</a>	<a href="#">Power Certificate</a>
<a href="#">Integrated Circuit Testing Certificate</a>	<a href="#">Semiconductor Materials and Devices Certificate</a>

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## Communications Systems Certificate

Certificate Advisor: Dr. Yong Jin Kim

Take all of these required courses:

ECE 300 Continuous-Time Signals Systems  
ECE 380 Discrete-Time Signals and Systems  
MA 381 Introduction to Probability with Applications to Statistics

Plus any four courses from the following list. Additional courses not in this list may be approved by the Certificate Advisor.

ECE 310 Communication Systems  
ECE 312 Communication Networks  
ECE 412 Software Defined Radio  
ECE 414 Wireless Systems  
ECE 512 Probability, Random Processes, and Estimation  
ECE 553 Radio-Frequency Integrated Circuit Design  
CSSE 432 Computer Networks  
MA 476 Algebraic Codes

## CONSULTING ENGINEERING PROGRAM CERTIFICATE

Through the generosity of J. B. Wilson, a prominent consulting engineer of Indianapolis, a program was established in 1973 to emphasize career opportunities in the field of consulting engineering and to provide selected courses which would be beneficial to students interested in consulting engineering careers.

Listed below is a program guide of recommended courses for a student interested in consulting engineering. This is not a degree program but is a supplement to the normal engineering degree programs. Some of the courses are in addition to the normal engineering degree programs and may result in a student earning more credits than are required for the B.S. degree in a specific discipline.

Students desirous of pursuing the Consulting Engineering Program should enroll in the Program by filing a declaration-of-intent form with the Program advisor, who serves as Chair of the Program. In order to be certified as having completed the Program, a student is required to successfully complete the prescribed list of courses, complete the requirements for a degree in Engineering, and take the Fundamentals of Engineering examination prior to graduation.

Upon completion of the program, students will receive a Certificate of Completion at the time of their graduation from Rose-Hulman Institute of Technology. Completion of the program will be noted on the student's official transcript but not on the diploma. The Consulting Engineering Program advisor is Dr. Kevin Sutterer P.E., Ph.D., Department of Civil and Environmental Engineering.

[Download the Consulting Engineering Intention Form](#)

Course	Credit
EM 102 Graphical Communications for Civil Engineers	2
Or	
EM 104 Graphical Communications	
Or	
BE 118 Design Thinking & Communication	
Or	
ENGD 100 Design & Communication Studio	
ENGL H290 Technical Communications	4
Or	
ENGD 250 Human-Computer Interfaces Studio	
ECON S253 Managerial Economics	4
Or	
EMGT 432/532 Technical Entrepreneurship	
CE303 Engineering Economy	4
Or	
CHE416 Chemical Engineering Design 1	
Or	
EMGT 467 Economic Analysis of Engineering Projects	
EMGT552 Business Law for Technical Managers	4
Or	
EMGT 551 Intellectual Property for Scientists and Engineers	
MDS 450 Consulting Engineering Seminar	2
Engineering Design (any senior capstone design course or courses)	4
Total	24

Exceptions to these program course requirements require approval by the Consulting Engineering Program Advisor.

## INTEGRATED CIRCUIT TESTING CERTIFICATE

Testing integrated circuits is a critical element in the integrated circuit industry. In fact, testing has become the bottle-neck for many companies, with inefficient test programs preventing the release of products onto the market. With few colleges offering courses in this area, students at RHIT have a unique specialization opportunity, making them marketable and extremely valuable in the integrated circuit industry.

This certificate intends to provide the student with a solid background in test and product engineering and broaden that background with other courses pertinent to the test and product engineering field. A strong test/product engineer requires knowledge about integrated circuit design, systems design, board design, semiconductor fabrication, and statistics. Therefore, courses in these areas can be chosen for the elective portion of the certificate.

The test and product engineering certificate could be completed by an electrical or computer engineering student without overloading if the certificate courses are mapped to all but one of the Area, Technical, and Free electives. Electives have been chosen so that students can pursue the semiconductor certificate or a math minor in conjunction.

### Certificate Requirements

**ECE351: Analog Electronics is required.**

**Two of the three testing courses are required.**

ECE557: Analog Test and Product Engineering  
ECE558: Mixed-Signal Test and Product Engineering  
ECE531: Digital Test and Product Engineering

**Three of ten elective courses are required.**

ECE551: Digital VLSI  
ECE552: Analog Integrated Circuit Design  
ECE553: RF Integrated Circuit Design  
ECE343: High-Speed Digital Design (required for CPE program)  
ECE416: Intro to MEMS  
ECE419: Advanced MEMS  
ECE454: System Level Analog Electronics  
ECE557: Analog Test and Product Engineering (if not used for required testing course)  
ECE558: Mixed-Signal Test and Product Engineering (if not used for required testing course)  
ECE531: Digital Test and Product Engineering (if not used for required testing course)  
PH405: Semiconductor Materials and Device I  
EP406: Semiconductor Materials and Devices II  
MA385: Quality Methods Engineering  
MA387: Statistical Methods in Six Sigma

For further information about the certificate program, please contact Tina Hudson ([HUDSON@rose-hulman.edu](mailto:HUDSON@rose-hulman.edu)).

# Optical Communications Certificate

Faculty advisors: Drs. Alisafae, Duree, Joenathan, Reza, Siahmakoun, and Granieri  
Rose-Hulman has become a leader in providing opportunities for students to choose a great mainstream degree program with flexibility to specialize in other areas of interest. This leadership is in no way limited to only traditional areas of study. One of these new areas that had a high impact in technology is optical communications. It is a rapidly growing field requiring investment beyond the traditional program structure, and is well suited to the students at Rose-Hulman All these topics are closely related to well established disciplines as optics and electronics. Considerable R&D efforts are allocated in both university and industrial laboratories enhancing the demand for both researchers and engineers with expertise in the field.

We propose the creation of a new certificate program in Optical Communications to enhance the programs currently offered. Combining expertise in Optical and Electrical Engineering, this program requires an interdisciplinary emphasis that is beyond the traditional content of either of its parent programs. This program is more than just the creation of the certificate program Optical Communications. This program will be critical to help developing a more interdisciplinary interaction for students and faculty. The creation of a workgroup within the faculty of both departments will coordinate current courses and resources, create new courses of interest for the field, and develop a showcase testbed education and research laboratory. Primary objectives include the removal of redundancy from existing courses, increasing interaction between the PHOE and ECE Departments, and improving opportunities for students in the field.

This certificate is designed to give the student a firm theoretical and practical working knowledge in the area of fiber optic devices, optical communications, networks and its applications. The main purpose is to couch these fundamentals in a context that serves as the backbone for device, components and sub-system development for use in high-speed optical data and information links and networks. At the end of the program the student will be expected to:

1. Understand the fundamental operation characteristics of high-speed optoelectronic components, such as laser transmitters, light modulators and receivers and passive fiber optic components as connectors, couplers, filters, and switches.
2. Understand the technology and performance of analog and digital fiber optic links, optical amplification and optical wavelength division multiplexing and optical time division multiplexing networks.
3. Have hands-on working knowledge of the use of fiber optic test equipment and techniques used by industry and telecommunication companies to test the performance of optical fiber links and components, such as, optical time domain reflectometry, optical spectrum analyzers and optical bit error testing equipment.

The Certificate will consist of 20 credit hours of which 12 credit hours will be required courses. Students interested in pursuing this Certificate should contact an ECE/ PHOE certificate advisor (Professors Duree, Granieri, Alisafae, Reza, Joenathan, Siahmakoun).

## Required Courses

- ECE 310 Communication Systems
- OE 393 Fiber Optics and Applications

- OE 493 Fundamentals of Optical Fiber Communications

### **Elective Courses (two from the list)**

Only courses not required for the student's major will count for electives in the certificate.

- ECE 380 Discrete Time & Continuous Systems
- ECE 410 Communication Networks
- ECE 414 Wireless Systems
- OE 360 Optical Materials
- OE 435 Biomedical Optics
- OE 450 Laser Systems and Applications

## **Power Certificate**

Take all of the following courses:

- ECE 473 Control of Power Systems, Pre: ECE 470
- ECE 472 Power System Protection, Pre: ECE 470 & ECE 471
- ECE 471 Power System Analysis II, Pre: ECE 470
- ECE 470 Power System Analysis I, Pre: ECE 370
- ECE 371 Conventional & Renewable Energy Systems, Pre: ECE 204
- ECE 370 Electric Machinery, Pre: ECE 204
- ECE 204 AC Circuits, Pre: ECE203 with a grade of C or better and PH113
- ECE 203 DC Circuits, Pre: MA111 and PH112

## **SEMICONDUCTOR MATERIALS AND DEVICES CERTIFICATE**

The Certificate will consist of 20 credit hours of which 12 credit hours will be required courses. Students interested in pursuing this Certificate should see a PHOE certificate advisor ( S. Kirkpatrick, Liptak, McInerney, Siahmakoun, Syed and Wagner). Students taking solid state/material science minor cannot take this certificate.

### **Required Courses**

1. PH405 Semiconductor Materials and Applications -- 3R-3L-4C F Pre: PH113 or PH255 or PH265 or consent of instructor.
2. EP406 Semiconductor Devices and Fabrication -- 3R-3L-4C W Pre: PH405 or consent of instructor.
3. EP410 Intro to MEMS: Fabrication and Applications -- 3R-3L-4C S Pre: JR or SR standing or consent of the instructor.  
or:  
CHE440 Process Control 4R-0L-4C W Pre: CHE202

## Electives

<b>COURSE</b>	<b>HOURS</b>	<b>COURSE TITLE</b>
OE 450	4	Laser Systems and Applications
OE 485	4	Electro-Optics and Applications
PH 330	4	Material Failure
PH 401	4	Introduction to Quantum Mechanics
PH 440	4	X-rays and Crystalline Materials
EP 408	4	Microsensors
EP 411	4	Advanced Topics in MEMS
ECE 351	4	Analog Electronics
ECE 551	4	Digital Integrated Circuit Design
ECE 552	4	Analog Integrated Circuit Design
ME 302	4	Heat Transfer
ME 328	4	Materials Engineering
ME 424	4	Composite Materials & Mechanics
ME 415	4	Corrosion and Engineering Materials
CHE 314	4	Heat Transfer
CHE 315	4	Material Science and Engineering
CHE 440	4	Process Control
CHE 441	4	Polymer Engineering
CHEM 441	4	Inorganic Chemistry I
CHEM 451	4	Organic Structure Determination
CHEM 457	4	Synthetic Polymer Chemistry
CHEM 462	4	Physical Polymer Chemistry
MA 381	4	Intro to Probability with Applications to Statistics
MA 385	4	Quality Methods
MA 487	4	Design of Experiments

## **Overall aim of the Certificate**

A certificate holder will understand how semiconductor devices work, have practical experience in the main stages of device production, have practical experience in the more common forms of device testing and characterization, and have broad understanding of the mechanical and chemical properties of the material used.

A Certificate holder will be well suited for jobs requiring an understanding of semiconductor devices and their production. These jobs include not only those directly related to device fabrication, but also those involved with testing and trouble-shooting electronic equipment and the design of machines that contain electronic equipment. The experience in simple device fabrication that the Certificate provides is particularly useful for future engineers in “process” industries.

Last updated: 09/22/2023

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