

Rose-Hulman Institute of Technology Course Catalog

Communications Systems Certificate	Optical Communications Certificate
Consulting Engineering Program Certificate	Power Certificate
Integrated Circuit Testing Certificate	Semiconductor Materials and Devices Certificate
International Studies Certificate	

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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 Engineer 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.

Registration for & sitting for the Fundamentals of Engineering Exam is required.

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).

INTERNATIONAL STUDIES CERTIFICATE

Certificate Advisor: Dr. Andreas Michel

In addition to the International Studies major, Rose-Hulman offers a certificate in International Studies. Like the major, the certificate is designed to introduce students to the diversity and complexity of the globalized world in which they will be working. Students may choose courses from a variety of disciplines, historical periods, and geographical areas from the list below.

Certificate Requirements (36 credits)

1. HUM H199 or SOC S199 Introduction to International Studies (4 credits)
2. First-year modern language proficiency (three courses, 12 credits)
3. Five courses with international studies content (20 credits) from this list:

ANTH S101 Introduction to Anthropology
ANTH S140 Introduction to East Asia
ANTH S151 Modern China
ANTH S150 Introduction to Islam
ANTH S207 Popular Culture in China
ANTH S208 Religions in China
ANTH S301 Japanese Society
ANTH S302 Japanese Society Seminar
ANTH S303 Japanese Popular Culture
ANTH S304 Japan: East and West
ANTH S350 Islam and Muslim Groups in China
ANTH S351 Ethnicity and State in China
ANTH S399 Cultures of Tibet
ARTS H242 Visual Arts in Civilization
ARTS H442 Art History
ECON S151 Introduction to Microeconomics
ECON S152 Introduction to Macroeconomics
ECON S351 Environmental Economics
ECON S355 International Finance
ECON S354 International Trade and Globalization
ECON S399 Development Economics
ENGL H233 World Literature
ENGL H330 Contemporary Global Film
ENGL H334 Travel in World Literature
ENGL H345 Literature of Conflict
ENGL H431 Literary London
ENGL H462 Transnational and Colonial Literature
ENGL H469 Contemporary British Fiction and Film
HIST H221 Colonial Latin America
HIST H222 Latin America Since 1800
HIST H223 World History since 1400

HIST H422 The Industrial Revolution in Global Context
HUM H311 German Colonialism
HUM H380 Literature and Human Rights in Latin America
MUSI H301 Musics of the Global South
POLS S102 International Relations
POLS S103 Comparative Politics
POLS S200 Politics of the Global Economy
POLS S301 European Politics and Government
POLS S303 The European Union
POLS S304 British Politics and Government

1. Course substitutions can be made with the consent of the International Studies Coordinator.
2. Courses counted for the International Studies certificate **may not be counted for HSSA minors**—except that modern foreign language courses may be used to fulfill modern language requirements in one additional minor.
3. Students who complete the requirements for the International Studies Major cannot also be awarded the International Studies Certificate.

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 (Pfiester Latham, 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

COURSE	HOURS	COURSE TITLE
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

COURSE	HOURS	COURSE TITLE
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.

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