Master of Science in Electrical and Computer Engineering

Concentrations: Photonics; Telecommunications and Networking

Focus Areas: Computer Engineering, Electronics and the Solid State, Optics and Photonics, RF and Microwave Engineering, Signal Processing, Systems and Control,Telecommunications and Networking

Post-Master's Certificate in Electrical and Computer Engineering

Graduate Certificate in Electrical and Computer Engineering

COURSES

FOCUS AREAS

The focus areas offered represent technology groupings that are relevant for students with interests in the selected areas. Students are not required to choose a focus area to follow. They only serve as an aid to students in planning their course schedules and are only applicable to students seeking a master's degree. They do not appear as official designations on a student's transcript or diploma.

COMPUTER ENGINEERING

525.410 Microprocessors for Robotic Systems
525.412 Computer Architecture
525.415 Embedded Microprocessor Systems
525.434 High-Speed Digital Design and Signal Integrity
525.441 Computer and Data Communication Networks I
525.442 FPGA Design Using VHDL
525.712 Advanced Computer Architecture
525.723 Computer and Data Communication Networks II
525.742 System-on-a-Chip FPGA Design Laboratory
525.743 Embedded Systems Development Laboratory
525.778 Design for Reliability, Testability, and Quality Assurance
525.786 Human Robotics Interaction

ELECTRONICS AND THE SOLID STATE

525.406 Electronic Materials
525.407 Introduction to Electronic Packaging
525.421 Introduction to Electronics and the Solid State I
525.422 Introduction to Electronics and the Solid State II
525.424 Analog Electronic Circuit Design I
525.428 Introduction to Digital CMOS VLSI
525.432 Analog Electronic Circuit Design II
525.451 Introduction to Electric Power Systems
525.713 Analog Integrated Circuit Design
525.725 Power Electronics

OPTICS AND PHOTONICS

525.413 Fourier Techniques in Optics
525.425 Laser Fundamentals
525.436 Optics and Photonics Laboratory
525.491 Fundamentals of Photonics
525.753 Laser Systems and Applications
525.756 Optical Propagation, Sensing, and Backgrounds
525.772 Fiber-Optic Communication Systems
525.792 Electro-Optical Systems
525.796 Introduction to High-Speed Electronics and Optoelectronics
525.797 Advanced Fiber Optic Laboratory

RF AND MICROWAVE ENGINEERING

525.405 Intermediate Electromagnetics
525.418 Antenna Systems
525.420 Electromagnetic Transmission Systems
525.423 Principles of Microwave Circuits
525.448 Introduction to Radar Systems
525.454 Communications Circuits Laboratory
525.484 Microwave Systems and Components
525.736 Smart Antennas for Wireless Communications
525.738 Advanced Antenna Systems
525.754 Wireless Communication Circuits
525.771 Propagation of Radio Waves in the Atmosphere
525.774 RF and Microwave Circuits I
525.775 RF and Microwave Circuits II
525.779 RF Integrated Circuits
525.787 Microwave Monolithic Integrated Circuit (MMIC) Design
525.788 Power Microwave Monolithic Integrated Circuit (MMIC) Design
525.791 Microwave Communications Laboratory
615.442 Electromagnetics

**SIGNAL PROCESSING**
525.419 Introduction to Digital Image and Video Processing
525.427 Digital Signal Processing
525.430 Digital Signal Processing Lab
525.431 Adaptive Signal Processing
525.443 Real-Time Computer Vision
525.446 DSP Hardware Lab
525.448 Introduction to Radar Systems
525.718 Multirate Signal Processing
525.721 Advanced Digital Signal Processing
525.724 Introduction to Pattern Recognition
525.728 Detection and Estimation Theory
525.744 Passive Emitter Geo-Location
525.745 Applied Kalman Filtering
525.746 Image Engineering
525.747 Speech Processing
525.748 Synthetic Aperture Radar
525.762 Signal Processing with Wavelets
525.780 Multidimensional Digital Signal Processing

**SYSTEMS AND CONTROL**
525.409 Continuous Control Systems
525.414 Probability and Stochastic Processes for Engineers
525.445 Modern Navigation Systems
525.461 UAV Systems and Control
525.466 Linear System Theory
525.744 Passive Emitter Geo-Location
525.763 Applied Nonlinear Systems
525.770 Intelligent Algorithms
525.777 Control System Design Methods
615.441 Mathematical Methods for Physics and Engineering
625.743 Stochastic Optimization and Control

**TELECOMMUNICATIONS AND NETWORKING**
525.408 Digital Telephony
525.414 Probability and Stochastic Processes for Engineers
525.416 Communication Systems Engineering
525.418 Antenna Systems
525.420 Electromagnetic Transmission Systems
525.438 Introduction to Wireless Technology
525.440 Satellite Communications Systems
525.441 Computer and Data Communication Networks I
525.454 Communications Circuits Laboratory
525.707 Error Control Coding
525.708 Iterative Methods in Communications Systems
525.722 Wireless and Mobile Cellular Communications
525.723 Computer and Data Communication Networks II
525.735 MIMO Wireless Communications
525.736 Smart Antennas for Wireless Communications
525.738 Advanced Antenna Systems
525.747 Speech Processing
525.751 Software Radio for Wireless Communications
525.754 Wireless Communication Circuits
525.759 Image Compression, Packet Video, and Video Processing
525.761 Wireless and Wireline Network Integration
525.768 Wireless Networks
525.771 Propagation of Radio Waves in the Atmosphere
525.772 Fiber-Optic Communication Systems
525.776 Information Theory
525.783 Spread-Spectrum Communications
525.789 Digital Satellite Communications
525.791 Microwave Communications Laboratory
525.793 Advanced Communication Systems

**COURSES BY CONCENTRATION**

**PHOTONICS**

**CORE COURSES (ONLY ONE 615.XXX COURSE IS REQUIRED)**
525.413 Fourier Techniques in Optics
525.425 Laser Fundamentals
525.491 Fundamentals of Photonics
615.441 Mathematical Methods for Physics and Engineering
615.454 Quantum Mechanics
615.471 Principles of Optics

**ELECTIVES FOR THE CONCENTRATION (SELECT THREE)**
525.436 Optics and Photonics Laboratory
525.753 Laser Systems and Applications
525.756 Optical Propagation, Sensing, and Backgrounds
525.772 Fiber-Optic Communication Systems
525.792 Electro-Optical Systems
525.796 Introduction to High-Speed Electronics and Optoelectronics
525.797 Advanced Fiber Optic Laboratory
585.634 Biophotonics
615.751 Modern Optics
615.758 Modern Topics in Applied Optics
615.778 Computer Optical Design
615.780 Optical Detectors and Applications
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>615.781</td>
<td>Quantum Information Processing</td>
</tr>
<tr>
<td>615.782</td>
<td>Optics and MATLAB</td>
</tr>
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<td><strong>Note:</strong> 525.801 and 525.802 Special Project courses can also be used to allow students to pursue specialized interests in optics.</td>
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</tbody>
</table>

### TELECOMMUNICATIONS AND NETWORKING

**SELECT FIVE**

- 525.408 Digital Telephony
- 525.414 Probability and Stochastic Processes for Engineers
- 525.416 Communication Systems Engineering
- 525.418 Antenna Systems
- 525.420 Electromagnetic Transmission Systems
- 525.438 Introduction to Wireless Technology
- 525.440 Satellite Communications Systems
- 525.441 Computer and Data Communication Networks I
- 525.454 Communications Circuits Laboratory
- 525.707 Error Control Coding
- 525.708 Iterative Methods in Communications Systems
- 525.722 Wireless and Mobile Cellular Communications
- 525.723 Computer and Data Communication Networks II
- 525.735 MIMO Wireless Communications
- 525.736 Smart Antennas for Wireless Communications
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- 525.747 Speech Processing
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- 525.759 Image Compression, Packet Video, and Video Processing
- 525.761 Wireless and Wireline Network Integration
- 525.768 Wireless Networks
- 525.771 Propagation of Radio Waves in the Atmosphere
- 525.772 Fiber-Optic Communication Systems
- 525.776 Information Theory
- 525.783 Spread-Spectrum Communications
- 525.789 Digital Satellite Communications
- 525.791 Microwave Communications Laboratory
- 525.793 Advanced Communication Systems

**SELECT TWO**

- 605.471 Principles of Data Communications Networks
- 605.472 Computer Network Architectures and Protocols
- 605.473 High-Speed Networking Technologies
- 605.474 Network Programming
- 605.475 Protocol Design and Simulation
- 605.477 Internetworking with TCP/IP I
- 605.478 Cellular Communications Systems
- 605.771 Wired and Wireless Local and Metropolitan Area Networks
- 605.772 Network and Security Management
- 605.775 Optical Networking Technology
- 605.776 Fourth-Generation Wireless Communications: WiMAX and LTE
- 605.777 Internetworking with TCP/IP II
- 605.778 Voice Over IP
- 695.422 Web Security
- 695.701 Cryptology
- 695.721 Network Security

*Please refer to the course schedule (ep.jhu.edu/schedule) published each term for exact dates, times, locations, fees, and instructors.*