Universidad Politécnica de Puerto Rico
Graduate School
Doctor of Philosophy in Engineering
and Applied Sciences

<table>
<thead>
<tr>
<th>Principal Areas of Study</th>
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<tbody>
<tr>
<td>Civil Engineering</td>
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<tr>
<td>– Construction</td>
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<tr>
<td>– Geotechnical</td>
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<tr>
<td>– Structures</td>
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<tr>
<td>– Water Resources &amp; Water Treatment</td>
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<tr>
<td>Computer Engineering</td>
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<tr>
<td>Electrical Engineering</td>
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<tr>
<td>Manufacturing Engineering</td>
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<tr>
<td>Mechanical Engineering</td>
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<tr>
<td>– Design</td>
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<tr>
<td>– Thermal and Fluid Mechanics</td>
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<td>– Aerospace</td>
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<th>Supplementary Areas of Study</th>
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<tbody>
<tr>
<td>Computer Science</td>
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<tr>
<td>Geospatial Science and Technology</td>
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<tr>
<td>Management</td>
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<tr>
<td>– Business Administration</td>
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<td>– Engineering Management</td>
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<tr>
<td>– Environmental Management</td>
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<td>Manufacturing Competitiveness</td>
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**Ph.D.**
Doctor of Philosophy in Engineering and Applied Sciences

<table>
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<tr>
<th>Principal Area of Study</th>
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<tr>
<td>Engineering Courses: 12 credit-hours</td>
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<th>Supplementary Area of Study</th>
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<tr>
<td>Other Engineering Discipline or Related Area Courses: 9 credit-hours</td>
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| Advanced Graduate Courses: 12 credit-hours |
| Doctoral Seminar: 6 credit-hours |
| Qualitative & Quantitative Research Methods Course: 3 credit-hours |
| Comprehensive Exam: 0 credit-hours |
| Dissertation: 18 credit-hours |

Total: 60 credits

Contact Information:
Graduate School
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Phone: 787-622-8000 Ext. 686

Rev. FA-21
Principal Area of Study Core Courses*

* The student could substitute at most 3 credit-hours (one core course) by another graduate course if recommended and approved by his/her advisor or the graduate dean. The student could substitute at most 3 credit-hours (one core course) by other graduate courses if recommended and approved by his/her advisor or the graduate dean.

Civil Engineering - Structures
- CE 6320 – Advanced Strength of Materials
- CE 6330 – Advanced Topics in Structural Engineering
- CE 6350 – Dynamics of Structures

Select one of the following Math courses:
- CECS 6370 – Finite Element Methods in Engineering
- MMP 6000 – Advanced Statistics and Quality Improvement

Civil Engineering - Water Resources & Water Treatment
- CE 6250 – Advanced Hydrologic and Hydraulic Models
- CE 6410 – Water and Wastewater Treatment Applications
- CE 6460 – Water Quality Control and Management

Select one of the following Math courses:
- CECS 6210 – Probability and Statistics in Water Resources
- MMP 6000 – Advanced Statistics and Quality Improvement

Civil Engineering - Geotechnical
- CE 6100 – Soil Shear Strength
- CE 6335 – Advanced Foundations
- CE 6355 – Advanced Earthquake Engineering

Select one of the following Math courses:
- CECS 6370 – Finite Element Methods in Engineering
- MMP 6000 – Advanced Statistics and Quality Improvement

Civil Engineering - Construction
- CE 6520 – Construction Contracting and Procurement
- CE 6530 – Schedule Impact Analysis
- CE 6533 – Construction Cost Control

Select one of the following Math courses:
- CECS 6512 – Value Engineering
- MMP 6000 – Advanced Statistics and Quality Improvement

Manufacturing Engineering
- MMP 6000 – Advanced Statistics and Quality Improvement
- MMP 6002 – Operations Planning And Control
- MMP 6006 – Lean Manufacturing
- MMP 6130 – Six Sigma

Electrical Engineering
- EE 6010 – Mathematical Methods for Signal Processing
- EE 6020 – Stochastic Processes
- EE 6030 – Linear Systems
- EE 6760 – Digital Communications Systems

Computer Engineering
- CECS 6120 – Computer Architecture
- CECS 6130 – Data Communication Networks
- CECS 6150 – Object-Oriented Design
- CECS 6510 – Software Engineering I

Mechanical Engineering – Design
- ME 6014 – Advanced Engineering Mathematics
- ME 6200 – Advanced Solid Mechanics
- ME 6330 – Finite Element Analysis
- ME 6360 – Optimization in Engineering Design

Mechanical Engineering – Thermal And Fluid Mechanics
- ME 6014 – Advanced Engineering Mathematics
- ME 6100 – Advanced Thermodynamics
- ME 6120 – Advanced Fluid Mechanics
- ME 6360 – Optimization in Engineering Design

Mechanical Engineering – Aerospace
- ME 6014 – Advanced Engineering Mathematics
- ME 6140 – High Speed Aerodynamics
- ME 6300 – Advanced Aerospace Structures
- ME 6350 – Mechanical and Aerospace Control Systems

Supplementary Area of Study Core Courses**

** The student must select 9 credit-hours. These credit-hours could be distributed between two Supplementary Areas of Study as recommended and approved by his/her advisor. Also, the student could substitute at most 3 credit-hours (one core course) by other graduate courses if recommended and approved by his/her advisor or the graduate dean.

Manufacturing Engineering
- MBA 5600 – Managerial Economics
- MBA 5700 – Managerial Marketing
- MBA 6830 – Operations Management
- MGM 6620 – Managerial Finances

Environmental Management
- EPM 6880 – Solid Waste Management
- EPM 6881 – Environmental Regulations
- EPM 6885 – Management for Sustainable Future
- MMP 6000 – Advanced Statistics and Quality Improvement

Advanced Graduate Courses
- EAS 6130 – Advanced Theory of Elasticity
- EAS 6131 – Nonlinear Finite Element Methods
- EAS 6140 – Sustainable Engineering
- EAS 8200 – Manufacturing Systems Analysis
- EAS 8210 – Statistical Modeling for Resources Optimization
- EAS 8310 – Energy Management
- EAS 8320 – Modeling and Simulation
- EAS 8400 – Advanced Optimization and Modeling
- EAS 8401 – Advanced Vibrations
- EAS 8902 – Doctoral Independent Study

Common Doctoral Courses
- EAS 8900 – Comprehensive Examination (0 credit-hour)
- EAS 8901 – Doctoral Seminar (1 credit-hour)
- EAS 8910 – Qualitative & Quantitative Research Methods
- EAS 9000 – Doctoral Dissertation (6 credit-hours per trimester)
- EAS 9001 – Doctoral Dissertation Extension (0 credit-hour)