Retention Initiatives for Undergraduate Engineering Students

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University of Central Florida
www.ucf.edu
Who is UCF?

- Established in 1963 in Orlando Florida (first classes in 1968), Metropolitan Research University
- Grown from 2,600 to 39,000 students in 34 years
  - 32,500 undergraduates and 6,500 graduates
- Doctoral intensive
  - 76 Bachelors, 62 Masters, 3 Specialist, and 20 PhD programs
- Second largest undergraduate enrollment in state
- Approximately 1,000+ faculty and 2,800 staff
- Six colleges and two schools
  - Arts and Sciences, Business Administration, Education, Engineering and Computer Science, Health and Public Affairs, Honors, Optics, and Hospitality Management
The College of Engineering & Computer Science (CECS)

Fall 2002 Fast Facts:
- 10 ABET-accredited programs
- Avg. SAT for incoming freshmen: 1200
- 54 National Merit Scholars

2002 Profile
- Top 8% in UG enrollment
- Top 5% Electrical/Computer Engineering Bachelor’s degrees awarded
- Top 10% Civil Engineering Bachelor’s degrees awarded
- Top 11% Mechanical Engineering Bachelor’s degrees awarded
- Top 6% Bachelor’s degrees awarded to Hispanics

CECS UG Enrollment: 4,380

<table>
<thead>
<tr>
<th></th>
<th>F</th>
<th>A</th>
<th>B</th>
<th>H</th>
<th>AI</th>
<th>Int</th>
<th>W</th>
<th>U</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>702</td>
<td>399</td>
<td>333</td>
<td>492</td>
<td>42</td>
<td>139</td>
<td>2,854</td>
<td>121</td>
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</table>

F=Female, A=Asian, B=African American, H=Hispanic, AI=American Indian, Int=International, W=White, U=Not Reported
Mission of CECS
www.cecs.ucf.edu

To further the knowledge and practice of the engineering and computer science professions in Central Florida, the state, and the nation by:

- Providing the highest quality and innovative learning/teaching environment in undergraduate and graduate curricula, preparing a diverse student body to be effective, contributing members of a technological society and life-long learners.
- Expanding the knowledge base of engineering and computer science through dynamic research and applying new discoveries for problem solving.
- Providing collaborative leadership with external partners in advancing technological breakthroughs for the economic and social well being of humankind.
- Extending educational opportunities to technology practitioners locally, nationally, and globally to enhance human performance, and economic and technical development.
Topics

Initiatives to retain students:

- Programs
- Curricular changes
- Support services
- Professional development
Programs

- Orientation
- Academic and Career Advisement
- Mentoring
- Outreach and Bridge Programs
- Freshman Experience
Orientation

- New student orientation is mandatory and strictly enforced.
  - Hold on record until orientation is completed, then allowed to register.
- Large group presentation with generic information and handouts.
  - Includes strategies for success
    - Difficulty of coursework, distractions (friends, work, other interests), time management, money problems, length of program, staying healthy.
- Parent orientation
Orientation

- Large group broken into smaller groups by major for faculty presentation and advisement in the corresponding departments.
  - Content determined by each department.
  - Faculty advisors give an overview of their program, answer questions, address student success, place emphasis math and science pre-requisites, encourage involvement in student organizations in the college and department to develop relationships with faculty and other students in their major.
  - Faculty advisors are available for future advising through e-mail, by phone, or individual appointments.
- CECS is the only college at UCF with this level of faculty and college participation in freshman advising.
- The same procedure applies for transfer students.
Academic Advisement

- First Year Advising and Exploration Office was established as a proactive retention initiative to maintain an ongoing, supportive relationship with students through their first year.
- Students are assigned an academic adviser in CECS AND First Year Advising.
- CECS Academic Affairs Office works closely with the First Year Advising Office.
- Students also have access to their faculty advisor in their major.
- For Mechanical and Aerospace students, meeting with their faculty advisor is mandatory.
  - Hold is put on student records until advisement is completed with the faculty advisor, then students allowed to register.
Indicator of Success

- Spring 1996, First Year (FY) Advising Office established
- Research shows that the type, nature, and frequency of the relationship between students and their advisor(s) are critical factors in their retention and academic success.
- CECS FTIC cohort retained after one year at UCF by cohort year fell from 76% in 1990 to 66% in 1996, then rose to 80% in 2001.
- CECS FTIC retention rate of 80% approximates the national rate of 82.1% (based on the STEM 2000 cohort continuation rates to the second year institution-wide as published in the 2001-2002 STEM Retention Report by the Consortium for Student Retention Data Exchange).
## Indicator of Success
### CECS FTIC Institution-Wide Retention

<table>
<thead>
<tr>
<th>Year</th>
<th>Cohort #</th>
<th>Still Enrolled #</th>
<th>Still Enrolled %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>242</td>
<td>185</td>
<td>76</td>
</tr>
<tr>
<td>1991</td>
<td>246</td>
<td>179</td>
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<tr>
<td>1992</td>
<td>212</td>
<td>164</td>
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<td>1993</td>
<td>230</td>
<td>173</td>
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<tr>
<td>1994</td>
<td>235</td>
<td>160</td>
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</tr>
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<td>1995</td>
<td>225</td>
<td>166</td>
<td>74</td>
</tr>
<tr>
<td>1996</td>
<td>256</td>
<td>170</td>
<td>66</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Cohort #</th>
<th>Still Enrolled #</th>
<th>Still Enrolled %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>284</td>
<td>203</td>
<td>72</td>
</tr>
<tr>
<td>1998</td>
<td>413</td>
<td>301</td>
<td>73</td>
</tr>
<tr>
<td>1999</td>
<td>402</td>
<td>309</td>
<td>77</td>
</tr>
<tr>
<td>2000</td>
<td>635</td>
<td>511</td>
<td>81</td>
</tr>
<tr>
<td>2001</td>
<td>670</td>
<td>539</td>
<td>80</td>
</tr>
</tbody>
</table>

Cohort criteria: fall full-time FTICS in CECS retained after 1 year within the institution (UCF).
Career Advisement

Career Resource Center (CRC)
- First Year Advisor liaison in CRC
- A designated CRC staff member as liaison to CECS
- Help students align and manage their academic and career goals
- 8 Annual Career fairs
- Workshops
  - Are you in the right major?
  - Which is the best career for you?
  - From Freshman to Senior: becoming a successful professional
  - Internship search
  - Job strategies search
  - Career etiquette
  - Resumes and cover letters
  - Successful interviewing
  - Federal employment
  - How to work a career expo
  - Getting your job or internship on the GOLD Connection
Mentoring

- Minority Mentorship program through the Minority Engineering and Computer Science Programs office.
- The long term goal of the Mentorship program is to increase the number of aspiring Black, Hispanic, and Native American students remaining and graduating in the field of engineering.
- Students paired with faculty or industry mentors.
- In 2002, UCF ranked 20th among institutions that awarded bachelor’s degrees to Hispanics according to the National Center for Education Statistics.*
- UCF also ranked 51st in awarding the most Master’s degrees to Hispanic students in 1999-2000.*

Indicator of Success
CECS

CECS degrees awarded across all levels to Hispanics and African Americans exceed the nation’s rates.

### CECS Degrees Awarded to Hispanics Compared with the Nation’s (2002 ASEE Profile)

<table>
<thead>
<tr>
<th>Student Diversity</th>
<th>Bachelor’s Hispanic</th>
<th>Master’s Hispanic</th>
<th>Doctoral Hispanic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>#</td>
<td>%</td>
</tr>
<tr>
<td>UCF</td>
<td>10</td>
<td>47</td>
<td>8</td>
</tr>
<tr>
<td>Nation*</td>
<td>7</td>
<td>4,381</td>
<td>3</td>
</tr>
</tbody>
</table>

### CECS Degrees Awarded to African Americans Compared with the Nation’s (2002 ASEE Profile)

<table>
<thead>
<tr>
<th>Student Diversity</th>
<th>Bachelor’s African American</th>
<th>Master’s African American</th>
<th>Doctoral African American</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>#</td>
<td>%</td>
</tr>
<tr>
<td>UCF</td>
<td>6</td>
<td>29</td>
<td>4</td>
</tr>
<tr>
<td>Nation*</td>
<td>5</td>
<td>3,305</td>
<td>3</td>
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</tbody>
</table>

*ASEE 2002 Profile includes 320 participating institutions.
UCF Degree Totals: Bachelors = 491, Master’s = 210, PhD = 45
Nation Degree Totals: Bachelors = 67,031, Master’s = 31,346, PhD = 5,802
CECS bachelor’s and master’s degrees awarded to women exceed the nation’s rate.

### CECS Female Student Diversity by Degrees Awarded
Compared with the Nation’s (2002 ASEE Profile)

<table>
<thead>
<tr>
<th>Student Diversity</th>
<th>Bachelor’s Women</th>
<th>Master’s Women</th>
<th>Doctoral Women</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>#</td>
<td>%</td>
</tr>
<tr>
<td>UCF</td>
<td>23</td>
<td>111</td>
<td>23</td>
</tr>
<tr>
<td>Nation*</td>
<td>21</td>
<td>14,055</td>
<td>22</td>
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</tbody>
</table>

* ASEE 2002 Profile includes 320 participating institutions.
UCF Degree Totals: Bachelors = 491, Master’s = 210, PhD = 45
Nation Degree Totals: Bachelors = 67,031, Master’s = 31,346, PhD = 5,802
Peer Mentoring

- Freshman seminar experience
  - EGN 1006 Introduction to the Engineering Profession
  - EGN 1007 Engineering Concepts and Methods

- Juniors and Seniors peer mentors
  - Liaison between students and faculty
  - Confidant on the rigors of college life
  - Inspiration to persist through their program
  - Liaison with industry (Co-Ops, internships)
Outreach and Bridge Programs

- Southeastern Consortium for Minorities in Engineering (SECME)
- Internet Science and Technology Fair (ISTF)
- Junior Engineering Technical Society (JETS)
- Summer Engineering Institute
- Summer Programs for Careers in Engineering (SPACE)
K-12 Outreach

Pre-College Efforts
- SECME
- Internet Science & Technology Fair
- Junior Engineering Technical Society (JETS)
- Summer Engineering Institute
- Summer Programs for Careers in Engineering (SPACE)
- Math Placement Test & Pre-Calculus (if needed)
- Pre-Calculus Workshop

Student Progress
- Pre-High School
- High School
- Pre-Freshman Summer
- To Freshman Year

Pre-College
Freshman Experience

- Co-ops and Internships
- Undergraduate Research Opportunities
- Student Organizations
- Preparation for Graduate School
- Support Services
Educational Outcomes

- Team Players
- Integrity
- Customer Service Focus
- Excellent Communication Skills
- Adaptable, Willing to Accept Change
- Computer & Technical Skills
- Interest in Continuing Education
- More Women and Minorities
Curricular Changes

- Fall 1998, mandatory introductory seminar courses for engineering students
  - EGN 1006 Introduction to the Engineering Profession
  - EGN 1007 Engineering Concepts and Methods
- Collaborative approach to Calculus education
- Service learning
Interdisciplinary Programs

- Freshman seminar experience
  - **EGN 1006 Introduction to the Engineering Profession**
    First semester freshman course with goals of increasing retention and improving understanding of the different engineering disciplines. Course topics include college survival skills and an introduction to the engineering disciplines. Classroom activities taught in an active/cooperative learning environment are supplemented by hands-on labs, engaging students in disciplinary learning experiences.
  - **EGN 1007 Engineering Concepts and Methods**
    The second semester follow-up to EGN 1006. Course goals include increasing retention, introducing the engineering design process, promoting multi-disciplinary teamwork, and developing computing skills. The course uses hands-on, multi-disciplinary team projects as a basis for introducing academic topics.
FTIC retention rate rose from 54.5% for the Fall 97 cohort to 74.7% for the Fall 01 cohort, a 37% increase over a period of 5 years.

Fall 1997-2001 CECS cohorts enrolled in EGN 1006 and tracked for 1 year to the following Fall semester. EGN 1006 and 1007 were mandatory requirements as of Fall 98.
African Americans: decreased from 66.7% Fall 97 to 63.6% Fall 01.
Hispanics: increased from 40.7% Fall 97 to 73.9% Fall 01.
Males: increased from 56.6% Fall 97 to 75% Fall 01.
Females: increased 45.3% Fall 97 to 73% Fall 01.

Fall 1997-2001 CECS cohorts enrolled in EGN 1006 and tracked for 1 year to the following Fall semester. EGN 1006 and 1007 were mandatory requirements as of Fall 98.
### FTIC Retention

#### Enrolled in EGN 1006 and EGN 1007

<table>
<thead>
<tr>
<th>Population</th>
<th>97-98*</th>
<th>98-99</th>
<th>99-00</th>
<th>00-01</th>
<th>01-02</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage</td>
<td>54.5%</td>
<td>61.9%</td>
<td>68.6%</td>
<td>74.3%</td>
<td>74.7%</td>
</tr>
<tr>
<td># Retained</td>
<td>157</td>
<td>143</td>
<td>254</td>
<td>307</td>
<td>328</td>
</tr>
<tr>
<td># Initial</td>
<td>288</td>
<td>231</td>
<td>370</td>
<td>413</td>
<td>439</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage</td>
<td>45.3%</td>
<td>67.7%</td>
<td>75.9%</td>
<td>65.5%</td>
<td>73.0%</td>
</tr>
<tr>
<td># Retained</td>
<td>24</td>
<td>21</td>
<td>41</td>
<td>38</td>
<td>46</td>
</tr>
<tr>
<td># Initial</td>
<td>53</td>
<td>31</td>
<td>54</td>
<td>58</td>
<td>63</td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage</td>
<td>56.6%</td>
<td>61.0%</td>
<td>67.4%</td>
<td>75.8%</td>
<td>75.0%</td>
</tr>
<tr>
<td># Retained</td>
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<td>122</td>
<td>213</td>
<td>269</td>
<td>282</td>
</tr>
<tr>
<td># Initial</td>
<td>235</td>
<td>200</td>
<td>316</td>
<td>355</td>
<td>376</td>
</tr>
<tr>
<td><strong>Hispanic</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage</td>
<td>40.7%</td>
<td>73.1%</td>
<td>65.0%</td>
<td>73.2%</td>
<td>73.9%</td>
</tr>
<tr>
<td># Retained</td>
<td>11</td>
<td>19</td>
<td>26</td>
<td>41</td>
<td>34</td>
</tr>
<tr>
<td># Initial</td>
<td>27</td>
<td>26</td>
<td>40</td>
<td>56</td>
<td>46</td>
</tr>
<tr>
<td><strong>Black</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percentage</td>
<td>66.7%</td>
<td>68.8%</td>
<td>46.4%</td>
<td>63.2%</td>
<td>63.6%</td>
</tr>
<tr>
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<td>14</td>
<td>11</td>
<td>13</td>
<td>12</td>
<td>21</td>
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<tr>
<td># Initial</td>
<td>21</td>
<td>16</td>
<td>28</td>
<td>19</td>
<td>33</td>
</tr>
</tbody>
</table>

*Before advent of EGN 1006 and 1007*
Collaborative Approach to Calculus Education

- Multi-disciplinary: Syllabus developed by a team of engineering, physics, and mathematics faculty
- Team teaching: engineering and math faculty
  - Plan class activities together
  - Teach the class together
  - Share responsibility for the class
- Topics
  - Math professor: introduction to the topic and discussion of mathematical techniques
  - Engineering professor: application through real-world engineering problem solving
- Educational Outcome
  - Holistic learning experience in the area of engineering mathematics
  - Learning and retention of core calculus concepts
Service Learning

- Senior design projects
- Making Hard Lives Easier
  - Dr. Ted Conway, Associate Professor, Mechanical Engineering
    - Tools like the big red button used by a blind woman, who is immobile except for limited use of her left arm, to check out books to pupils and to maintain inventory control at an Orange County elementary school library. The big red switch activates machinery that laser-scans the bar codes on books and library cards. Students tell her when books are in place. She has become a productive member of society.
    - Non-jamming feed for a disabled man to use when shredding papers for the College of Education Library.
- Need to improve on including service learning in the curriculum
Support Services

- Academic and Career Advising
- Harris Computer Lab (CECS only)
- Health
  - Student Health Center
  - State-of-the Art Recreation and Wellness Center
- Mental Health
- Multicultural Academic and Support Services
- International Student Services
- Math Lab
- Student Academic Resource Center
- State-of-the-art Student Union
- Tutorial Center (CECS only)
Support Services

- **Math Lab**
  - "A Friendly Place to Learn Mathematics"

- **Minority Engineering and Computer Science Programs Office**
  - Free tutoring in engineering core courses
  - Boeing laptop computer loan program
    - Students can check out a laptop free of charge
  - Additional scholarship opportunities
Professional Development

Student organizations

- Air and Waste Management Association
- Alpha Pi Mu (Industrial Engineering Honors Society)
- American Institute of Aeronautics and Astronautics
- American Society of Heating Refrigeration and Air-Conditioning Engineers
- American Society of Civil Engineers
- American Society of Mechanical Engineers
- American Society for Quality Control
- American Water Resources Association
- Association for Computing Machinery
- Biomedical Engineering Society
- Chi Epsilon (Civil Engineering Honors Society)
- Engineering College Council
- Eta Kappa Nu (ECE Honor Society)
- Florida Engineering Society
- Florida Orienteering
- IEEE Society
- Institute of Industrial Engineers
- Institute of Transportation Engineers
- Society for Manufacturing Engineers
- Society of Automotive Engineers
- Society of Hispanic Professional Engineers
- Society of Women Engineers
- Students Association of Bangladesh
- Tau Beta Pi (National Engineering Honor Society)
- UCF Women's Club
- UCF Students for Exploration and Development of Space
Student Accomplishments

- **Computer Science**: The UCF student chapter of Association for Computing Machinery (ACM) has participated in the ACM International Collegiate Programming Contest for the past 21 years. In the Southeast Region (Florida, Georgia, South Carolina, Alabama, and Mississippi), UCF has always finished in the top 3 (1st place: 10 times, 2nd place: 5 times, 3rd place: 6 times). There are usually 85 teams competing in the Southeast Regional competitions, and our record is not matched by any other school in our region. UCF has finished as high as 2nd, 4th and 5th in World Contest Finals. It should be noted that finishing, for example, 5th in the 2002-2003 Contest Finals means 5th out of 3,800 teams, which means UCF finished in top 1% in the world! UCF overall performance is matched by very few schools in the world.

- **Environmental Engineering**: A team of 5 female, undergraduate Environmental Engineering students from UCF won 1st place and a prize of $8,000 in the 2003 Florida Water Environment Association (FWEA) Student Chapter Design Competition. The topic of the competition was to design an alternative to the City of Altamonte Springs' current treatment and disposal of biosolids. The students had to submit a document describing their selection and its design. The design will be considered for possible implementation at the facility. The team will be representing Florida at the national WEFTEC Conference in October 2003 in Los Angeles, California.

- **Mechanical Engineering**: The UCF student chapter of the Society of Automotive Engineers placed 1st in the Suspension event, 1st in the Pressure Washer event, and overall 14th out of the 50 participating institutions in the 2003 East Coast Mini Baja Competition. The East Mini Baja event is a national automotive competition that began in 1976 at the UCF College of Engineering. Some fifty universities from across the U.S., Canada, and Mexico participated in the East Mini Baja event held at UCF April 4-6, 2003. UCF was able to host this high caliber event with the corporate sponsorship of: The Society of Automotive Engineers, Briggs & Stratton Engines, Honda Research and Development, General Motors Corporation, Harris Corporation, MSC.Software, Polaris, Emergency One Rescue Vehicles, Ringhaver Equipment Co., and Orlando Yamaha Kawasaki.
Co-Op Opportunities

- Students have a faculty advisor.
- Students can participate in 1 of 2 methods:
  - Parallel: Students work part-time year round while attending school full-time.
  - Alternating: Students work as full-time employees every other term, alternating terms of full-time work with terms of full-time school.
- Designated Co-Op staff member as liaison to CECS.
- Available to undergraduate and graduate students with the following eligibility requirements:
  - Completed a minimum of 20 college semester hours.
  - Able to make a multiple semester work commitment.
  - Maintain a 2.5/4.0 UCF GPA.
Indicator of Success

- **Academic Year 2001-2002, CECS students placed with Co-Op employers**
  - Summer 2001
    - 154 students at 88 companies
  - Fall 2001
    - 146 students at 80 companies
  - Spring 2002
    - 130 students at 67 companies

- **Sample of Co-Op employers**
  - Kennedy Space Center
  - United Space Alliance
  - Eglen Air Force Base
  - Intel
  - Bell South
  - Naval Warfare Center
  - Dyer, Riddle, Mills, and Precourt Inc.
    (Civil Engineering)
  - Siemens
  - Boyle Engineering
  - Frito Lay
  - Rohwedder Inc
Lockheed-Martin Excellence Program

- Lockheed Martin desk in the Career Resource Center
- Provide students with opportunities to:
  - Gain professional work experience while maintaining full-time enrollment in classes.
  - Earn a portion of their expenses while in school.
  - Explore career options in a variety of settings.
  - Develop interpersonal and networking skills.
  - Obtain a unique training experience on the cutting edge of technology.
Lockheed-Martin Excellence Program

Eligibility requirements:

- Students pursuing a Bachelor’s degree must be enrolled full-time in a minimum of 12 credit hours and must have and maintain a minimum GPA of 3.0, both overall and UCF.
- Students pursuing a Master’s degree must be enrolled in a minimum of 6 credit hours and must have and maintain a minimum GPA of 3.2, both overall and UCF.
- Students must work a minimum of 12 hours in the fall and spring semesters. Graduate students and seniors in their last semester are permitted to work up to 30 hours per week.
- Students must have completed 1 semester at UCF.
- Students must have at least 2 semesters left before graduation.
- Students must be US citizens.
As of June 19, 2003, 62 CECS students are currently participating in the Lockheed Martin Work Study program:

- Computer Science - 12
- Information Systems Technology - 7
- Mechanical Engineering - 18
- Electrical Engineering - 12
- Computer Engineering - 8
- Aerospace Engineering - 3
- Civil Engineering - 1
- Industrial Engineering - 1
Undergraduate Programs

- Computer Science
- Computer Engineering
- Mechanical Engineering
- Electrical Engineering
- Civil Engineering
- Aerospace Engineering
- Industrial Engineering
- Environmental Engineering
- Information Technology
- Engineering Technology
University of Central Florida

College of Engineering and Computer Science

Reach for the stars!