Trends and Challenges in Korean Chemical Engineering Education

KAIST
Chemical & Biomolecular Engineering
Jae W. Lee, Department Head
2017. 10. 03
Number of University in Korea \( \equiv \) 350

Number of Dept. of Chemical Engineering \( \equiv \) 80 \( \equiv \) 23%

Number of Dept. of Industry Chemistry \( \equiv \) 10 \( \equiv \) 3%

Number of Dept. of Nano-related Engineering \( \equiv \) 30 \( \equiv \) 9%

Number of Dept. of Energy-related Engineering \( \equiv \) 60 \( \equiv \) 17%

Number of Dept. of Environmental-related Engineering \( \equiv \) 100 \( \equiv \) 29%

### Approximated % and average # of professors with non-ChemE (or similar) degrees

<table>
<thead>
<tr>
<th>University</th>
<th># of Prof. in ChemE</th>
<th># (%) of Prof. with ChemE</th>
<th># (%) of Prof. with Chem</th>
<th># (%) of Prof. with Bio</th>
<th># (%) of Prof. with Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seoul National University</td>
<td>32</td>
<td>27 (84.4)</td>
<td>3 (9.4)</td>
<td>1 (3.1)</td>
<td>1 (3.1)</td>
</tr>
<tr>
<td>KAIST</td>
<td>24</td>
<td>20 (83.3)</td>
<td>1 (4.2)</td>
<td>1 (4.2)</td>
<td>2 (8.3)</td>
</tr>
<tr>
<td>POSTECH</td>
<td>24</td>
<td>20 (83.3)</td>
<td>3 (12.5)</td>
<td>0 (0.0)</td>
<td>1 (4.2)</td>
</tr>
<tr>
<td>Yonsei University</td>
<td>20</td>
<td>18 (90.0)</td>
<td>1 (5.0)</td>
<td>0 (0.0)</td>
<td>1 (5.0)</td>
</tr>
<tr>
<td>Korea University</td>
<td>23</td>
<td>22 (95.7)</td>
<td>1 (4.3)</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
</tbody>
</table>
### Current State of Chemical Engineering in KAIST

#### Number of CBE Students in KAIST

<table>
<thead>
<tr>
<th>Category</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Undergraduate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enrollment (2 - 4th Yr)</td>
<td>385</td>
<td>379</td>
<td>396</td>
<td>429</td>
</tr>
<tr>
<td>Graduated</td>
<td>91</td>
<td>103</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td><strong>Graduate</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Enrollment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS</td>
<td>112</td>
<td>108</td>
<td>116</td>
<td>138</td>
</tr>
<tr>
<td>PhD</td>
<td>202</td>
<td>221</td>
<td>249</td>
<td>249</td>
</tr>
<tr>
<td>Graduated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MS</td>
<td>38</td>
<td>42</td>
<td>42</td>
<td>58</td>
</tr>
<tr>
<td>PhD</td>
<td>28</td>
<td>29</td>
<td>39</td>
<td>51</td>
</tr>
</tbody>
</table>

**Undergraduate**

- **Enrollment**: 385, 379, 396, 429
- **Graduated**: 91, 103, 90, 100

**Graduate**

- **Enrollment**: MS 112, 108, 116, 138; PhD 202, 221, 249, 249
- **Graduated**: MS 38, 42, 42, 58; PhD 28, 29, 39, 51

**Admission**: more applications than available table of organization (T/O)
Demand for ‘chemical engineers’ in the industry keeps increasing...
Research Areas

Energy & Environmental Systems
- D. Koh
- J. H. Kim
- J. H. Lee
- J. W. Lee
- Y. S. Kim
- Y. C. Kim
- H. G. Park
- S. Y. Lee
- Y. K. Chang
- K. J. Jeong

Catalysis
- S. B. Park
- H. J. Lee
- M. K. Choi
- D. H. Kim
- S. H. Kim
- D. C. Lee
- S. G. Im
- H. T. Jung
- E. S. Cho

Nanomaterials

Biotechnology

Soft Materials (Polymer)
- B. J. Kim
- H. T. Kim
- S. Li
- O. O. Park
- S. Y. Choi

Energy & Environmental Systems

Catalysis

Nanomaterials

Biotechnology

Soft Materials (Polymer)
Course Offerings in KAIST

Undergraduate Course Offerings (Representative)

**Broad Education**

**Fundamentals:**
- Introduction to Chemical and Biomolecular Engineering (CBE)
- Industrial Organic Chemistry
- CBE Analysis
- Chemical Engineering Thermodynamics
- Introduction to Numerical Methods for CBE
- Physical Chemistry for CBE
- Molecular Reaction Engineering
- Separation Processes
- Fluid Mechanics
- Heat and Mass Transfer
- CBE Capstone Design Project

**Experiments:**
- Molecular Engineering Laboratory
- CBE Laboratory

**Specialized Research Topics**

**Energy & Environmental Systems:**
- Process Simulation and Control
- Techniques of Process and Product Design
- Introduction to Environmental Engineering

**Nano Materials & Catalysis:**
- Nanochemical Technology

**Soft Materials:**
- Introduction to Macromolecular Engineering
- Electrochemical Principles for CBE

**Biotechnology:**
- Biomolecular Engineering
- Biochemical Engineering
- Bioinformatics
- Biorefineries for Fuels and Chemicals
Major Trends in Our Education

Utilization of Calculation and Simulation Tools

CBE 206. Introduction to Numerical Methods for Chemical and Biomolecular Engineering
MATLAB®

CBE 441. Techniques of Process and Product Design
Aspen Plus®

CBE 442. Chemical and Biomolecular Engineering Capstone Design Project
SuperPro Designer®
Graduate Course Offerings (Representative)

**Fundamentals:**
- Scientific Writing
- Research Methodology for Chemical and Biomolecular Engineers
- Problem Solving in CBE
- Engineering Applied Mathematics
- Numerical Method for Chemical Engineers
- Design of Reaction System
- Introduction to Interfacial Engineering
- Mass Transfer

**Energy & Environmental Systems:**
- Rate-controlled Separation Process
- Multiphase Reactor Engineering
- Advanced Process Control
- Process Optimization • Energy Engineering

**Nano Materials:**
- Thin Film Nanotechnology • Microfluidics
- Organic Nano-Structured Materials

**Soft Materials:**
- Introduction to Macromolecular Engineering
- Electrochemical Principles for CBE
- Polymer Fluid Dynamics

**Catalysis:**
- Introduction to Catalysis Engineering
- Catalysis for Renewables
- Theory of Catalysis • Design of Catalysis

**Biotechnology:**
- Metabolic Engineering
- Nucleic Acid Engineering
THANK YOU