The undergraduate program in Chemical Engineering

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An engineering graduate

Educational Objectives (for all graduates)

• graduates to become innovative, competent, contributing engineers in the process industries
• graduates to demonstrate their flexibility and adaptability in the workplace, so that they remain effective engineers, take on new responsibilities, and assume leadership roles
• graduates to continue their education by obtaining advanced degrees

From UCSB
The philosophy

- Enhance the following
  - Interdisciplinary – courses across depts
  - Flexibility
  - Larger number of Electives
  - Motivate/inspire students
  - Encourage self learning
  - Encourage students doing well
  - UG projects/research
  - Earning credits from outside IITK

The product

- Humane, global Indians who are leaders in their field
Overall character of ChE education

- **Fundamentals** –
  - knowledge of mathematics, computing, science, and engineering needed to practice chemical engineering and the ability to apply this knowledge to identify, formulate, and solve chemical engineering problem

- **Laboratory** –
  - the ability to design and conduct experiments and to analyze and interpret data

- **Design** –
  - ability to design a system, component, or process to meet desired specifications; ability to use modern engineering tools necessary for engineering practice
And some more

• **Advanced Training** –
  • beyond the basic fundamentals in at least one area of chemical engineering as preparation for a continuing process of lifelong learning

• **Teamwork/Communication** –
  • ability to function productively in multidisciplinary teams working towards common goals; the ability to communicate effectively through written reports and oral presentations

• **Engineering & Society** –
  • the broad education necessary to understand the impact of engineering solutions in a global/societal context; a knowledge of contemporary issues; an understanding of professional and ethical responsibility; a recognition of the need for and the ability to engage in lifelong learning
ChE@IITK_{2008}

- “The Department imparts graduate education with emphasis on chemical engineering fundamentals ... They are primarily intended to prepare students for teaching and R&D careers ...”
Chemical Engineering program at some IITs

- Courses that are required by all departments
- Advanced courses in Sciences and Engineering that are department specific
- Program subjects
- Electives

Alternatively:
- Basic Sciences
- Engineering Sciences
- Departmental
- Humanities

Electives (Open + Dept)
Others (Phy Edu, Mngmt, Foreign Language)
## Distribution of courses in some IITs

<table>
<thead>
<tr>
<th>IIT</th>
<th>HSS &amp; Management</th>
<th>Basic Science</th>
<th>Engineering Sciences + TA</th>
<th>Department (DE + OE)</th>
<th>Electives (DE + OE)</th>
<th>Total Dept</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOM</td>
<td>5</td>
<td>30</td>
<td>12</td>
<td>40</td>
<td>16.5 (12.5+4.0)</td>
<td>52.5</td>
</tr>
<tr>
<td>DEL</td>
<td>9</td>
<td>11</td>
<td>11</td>
<td>35.5</td>
<td>33 (14+19)</td>
<td>49.5</td>
</tr>
<tr>
<td>KNP</td>
<td>14</td>
<td>18.5</td>
<td>17.5</td>
<td>27</td>
<td>23 (9+14)</td>
<td>36</td>
</tr>
<tr>
<td>KGP</td>
<td>8</td>
<td>17</td>
<td>15.5</td>
<td>47</td>
<td>12.07</td>
<td>&gt; 47</td>
</tr>
<tr>
<td>MAD</td>
<td>7</td>
<td>18.5</td>
<td>11</td>
<td>48</td>
<td>15 (6.5+8.5)</td>
<td>54.5</td>
</tr>
<tr>
<td></td>
<td>5 to 14</td>
<td>11 to 30</td>
<td>11 to 17.5</td>
<td>Last col</td>
<td>4 to 8.5 (OE)</td>
<td>36 to 55</td>
</tr>
</tbody>
</table>
“Optimum” fraction in IITs

Department is 45-50% of courses

- HSS + Mngt (9.5%)
- Basic Sciences (20%)
- Engineering Sciences + TA (15%)
- O Electives
- Dept
- OE

Department (45%)
Courses we do in ChE@IIT

• The 1\textsuperscript{st} year
  – Devoted to establishing a Science and Engineering base for future courses (common to several/all disciplines); Humanities also important
  Physics, Chemistry, Mathematics, Computing, HSS, TA, etc.

• Departmental courses
  – Introduction to ChE (IITB, IITD, IITM)
  – Process Calculations (IITM)
  – Transport Phenomena (IITD)
  – None at IITK and IITKGP
All IITs have several ChE courses in the 2\textsuperscript{nd} Year

- B (7+1), D(7+2), K(4), KGP(4+2), M(7)
- Process Calculation (K, KGP)
- Chemical Engineering Thermo (All)
- Fluid Mech or similar (All)
- Chemical Process Technology/Industries (K,D,M)
- CRE-I (D)
- Labs - Fluid, HT, Fuels, Design
- Mech Operations (M)
Majority of courses finished by the 3\textsuperscript{rd} year & 4\textsuperscript{th} year for Finishing and Electives

- 3\textsuperscript{rd} year courses include:
  - Transport (HT & MT), Reaction, Process Control, Computer apps and Labs

- 4th year courses include:
  - Design, Projects, Labs and Electives (Dept + Open)
  - Minors and Honors
% Dept courses in the 4 years

IITK

1st Year  2nd Year  3rd Year  4th Qtr

IITD

1st Year  2nd Year  3rd Year  4th Qtr
Courses that make up ChE

- Process Calculations (along with Intro to ChE?)
- ChE Thermo (1 or 2?)
- Chemical Process Industries (1 or none or with above?)
- HT & MT (Transport Phenomena- 2 or 3?) and Fluids
- Reaction Engineering (2)
- Mechanical operations (?)

- Controls (1)
- Design (1 or 2)
- Projects (1 or 2)

- Labs (2 or 6?)
- Electives (2-4?)