International Certification in Engineering Education

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Tokyo Institute of Technology, Japan

- Accreditation of Educational Program
- Accreditation in JAPAN
- OECD-AHELO Project
1. Background

- The profession of engineering is becoming increasingly global. As a result, there is a need for international agreements governing mutual recognition of engineering qualifications and professional competence.

- Professional societies (council of engineers, institution of professional engineers, etc.) have been promoting their professional status and looking after engineering education through accreditation.
2. Accreditation of Educational Program

Washington Accord

- Established in 1989 by 6 accreditation bodies for engineering education in Australia, Canada, GB, Ireland, New Zealand and USA
- Accreditation bodies (of WA signatories) accredit educational programs with “similar” criteria
- Recognizes substantial equivalency of accredited programs under the Accord
# Washington Accord membership

<table>
<thead>
<tr>
<th>Accreditation bodies</th>
<th>Provisional status</th>
<th>Signatory</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Founding Members</td>
<td></td>
<td>1989</td>
</tr>
<tr>
<td>HKIE (HK)</td>
<td>No system at that time</td>
<td>1995</td>
</tr>
<tr>
<td>ECSA (South Africa)</td>
<td>1994</td>
<td>1999</td>
</tr>
<tr>
<td>JABEE (Japan)</td>
<td>2001</td>
<td>2005</td>
</tr>
<tr>
<td>IES (Singapore)</td>
<td>2003</td>
<td>2006</td>
</tr>
<tr>
<td>BEM (Malaysia)</td>
<td>2003</td>
<td>2009</td>
</tr>
<tr>
<td>ASIIN (Germany)</td>
<td>2003</td>
<td></td>
</tr>
<tr>
<td>ABEEK (RP Korea)</td>
<td>2005</td>
<td>2007</td>
</tr>
<tr>
<td>IEET (Chinese Taipei)</td>
<td>2005</td>
<td>2007</td>
</tr>
<tr>
<td>AEER (Russia)</td>
<td>2007</td>
<td>2012</td>
</tr>
<tr>
<td>AICTE (India)</td>
<td>2007</td>
<td></td>
</tr>
<tr>
<td>IESL (Sri Lank)</td>
<td>2007</td>
<td></td>
</tr>
<tr>
<td>MUDEK (Turkey)</td>
<td>2010</td>
<td>2011</td>
</tr>
<tr>
<td>PEC (Pakistan)</td>
<td>2010</td>
<td></td>
</tr>
<tr>
<td>COE (Thailand)</td>
<td>Submitted in 2010 but was differed</td>
<td></td>
</tr>
<tr>
<td>BAETE (Bangladesh)</td>
<td>2011</td>
<td></td>
</tr>
<tr>
<td>CAST (PR China)</td>
<td>Planning to submit in 2013</td>
<td></td>
</tr>
<tr>
<td>PTC (The Philippines)</td>
<td>Planning</td>
<td></td>
</tr>
<tr>
<td>Indonesia</td>
<td>Interest</td>
<td></td>
</tr>
</tbody>
</table>
Signatories to the Washington Accord

- Malaysia
- Turkey
- Bangladesh
- Russia
- Pakistan

2012 September

Signatory Member

Provisional Member
Steps to become a WA signatory

- **Provisional Status**
  
  Request should be submitted with recommendation letters from 2 signatories, who well know the accreditation system of that jurisdiction
  
  2/3 of the signatories should agree

- **Signatory**
  
  3 signatories appointed by the WA undertake a review and submit the report to WA.
  
  Unanimous agreement is needed
International Engineering Alliance (IEA)

Educational Accord
- Washington Accord
- Sydney Accord
- Dublin Accord

Competence Recognition/Mobility Agreements
- Engineers Mobility Forum
- APEC Engineer
- Engineering Technologist Mobility Forum
  - Professional Engineers
  - Engineering Technologist
  - Engineering Technicians
  - Professional Engineers
  - Professional Engineers (regional Agreement)
  - Engineering Technologist

JABEE
IPEJ

http://www.ieagreements.org/
International Engineering Alliance (IEA) Graduate Attributes & Professional Competencies

Educational and professional accords for mutual recognition of qualifications and registration have developed statements of graduate attributes and professional competency profiles.

<table>
<thead>
<tr>
<th>Educational Accord</th>
<th>Washington Accord</th>
<th>Sydney Accord</th>
<th>Dublin Accord</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Engineer</td>
<td>Professional Engineer</td>
<td>Engineering Technologist</td>
<td>Engineering Technician</td>
</tr>
<tr>
<td>Range of Problem Solving</td>
<td>Complex Problems</td>
<td>Broadly-defined Problems</td>
<td>Well-defined Problems</td>
</tr>
<tr>
<td>Range of Engineering Activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge Profiles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graduate Attributes Profiles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Professional Competencies Profiles</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

http://www.ieagreements.org/IEA-Grad-Attr-Prof-Competencies-v2.pdf
# Graduate Attributes Profiles

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Engineering knowledge</td>
</tr>
<tr>
<td>2</td>
<td>Problem Analysis</td>
</tr>
<tr>
<td>3</td>
<td>Design / Development of Solutions</td>
</tr>
<tr>
<td>4</td>
<td>Investigation</td>
</tr>
<tr>
<td>5</td>
<td>Modern Tool Usage</td>
</tr>
<tr>
<td>6</td>
<td>The Engineer and Society</td>
</tr>
<tr>
<td>7</td>
<td>Environment and Sustainability</td>
</tr>
<tr>
<td>8</td>
<td>Ethics</td>
</tr>
<tr>
<td>9</td>
<td>Individual and Team Work</td>
</tr>
<tr>
<td>10</td>
<td>Communication</td>
</tr>
<tr>
<td>11</td>
<td>Project Management and Finance</td>
</tr>
<tr>
<td>12</td>
<td>Life Long Learning</td>
</tr>
</tbody>
</table>
Other International Framework

- **EUR-ACE** (European Accreditation of Engineering Programs)

- **Seoul Accord** (Computing & IT-related Programs)
  JABEE joined in 2008 as a founding signatory

- **UNESCO-UIA** (Architectural Design & Planning)
  JABEE was recognized in 2008 as an accreditation body

- **Canberra Accord** (Architects)
3. Accreditation in JAPAN

Name of Organization:
JABEE
(Japan Accreditation Board for Engineering Education)
Chronicle :
1997 Preparation committee
1999 Establishment of JABEE
2001 Started accreditation
2005 Signatory of Washington Accord
Accreditations:
◆ Undergraduate Engineering Programs
◆ Master Engineering Programs
◆ Undergraduate Computing and IT-related Programs
◆ Undergraduate + Master in Architecture
◆ Professional Graduate Schools
JABEE Common Criteria
(Applicable in the years 2012)

1: Learning Outcomes

2: Educational Methods

3: Achievement of Learning Outcomes

4: Educational Improvement
Learning/Educational Objectives

(a) An ability of multidimensional thinking with knowledge from global perspective
(b) An ability of understanding of effects and impact of professional activities on society and nature, and of professionals’ social responsibility
(c) Knowledge of and ability to apply mathematics and natural sciences
(d) Knowledge of the related professional fields, and ability to apply
(e) Design ability to respond to requirements of the society by utilizing various sciences, technologies and information
(f) Communication skills including logical writing, presentation and debating
(g) An ability of independent and life-long learning
(h) An ability to manage and accomplish tasks systematically under given constraints
(i) An ability to work in a team
4. OECD-AHELO Project

What is AHELO?

- AHELO will test what students in higher education know and can do upon graduation. AHELO is a direct evaluation of student performance. It will provide data on the relevance and quality of teaching and learning in higher education. The test aims to be global and valid across diverse cultures, languages and different types of institutions.

Background

- The expansion of Higher Education, and the resulting demand for quality assurance.
- The globalization of Higher Education, and the resulting demand for transferability and comparability of degrees and credits.
Country Participation by Strand

• Generic skills: Colombia, Egypt, Finland, Korea, Kuwait, Mexico, Norway, the Slovak Republic and the US (Connecticut, Missouri, Pennsylvania).

• Economics: Belgium (Fl.), Egypt, Italy, Mexico, the Netherlands, the Russian Federation and the Slovak Republic.

• Engineering: Abu Dhabi, Australia, Canada (Ontario), Colombia, Egypt, Japan, Mexico, and the Slovak Republic.
## A Tuning-AHELO Conceptual Framework of Expected/Desired Learning Outcomes in Engineering

<table>
<thead>
<tr>
<th>EUR-ACE</th>
<th>ABET</th>
<th>Tuning-AHELO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge and Understanding</td>
<td>a) an ability to apply knowledge of mathematics, science, and engineering</td>
<td>Basic and Engineering Sciences</td>
</tr>
</tbody>
</table>
| Engineering Analysis           | b) an ability to design and conduct experiments, as well as to analyze and interpret data  
e) an ability to identify, formulate, and solve engineering problems | Engineering Analysis                                                       |
| Engineering Design             | c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability | Engineering Design                                                       |
| Investigations                 |                                                                      | (to Engineering Analysis)                                                  |
| Engineering Practice           | f) an understanding of professional and ethical responsibility 
j) a knowledge of contemporary issues  
k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice | Engineering Practice (Part of Generic Skills)                              |
| Transferable Skills            | d) an ability to function on multi-disciplinary teams  
g) an ability to communicate effectively  
h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context  
i) a recognition of the need for, and an ability to engage in lifelong learning | Generic Skills (Part of Knowledge and Understanding)                          |

**ENGINEERING ASSESSMENT FRAMEWORK**

**AHELO Feasibility Study**

<table>
<thead>
<tr>
<th>Engineering Processes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analysis</td>
</tr>
<tr>
<td>Design</td>
</tr>
<tr>
<td>Practice</td>
</tr>
</tbody>
</table>

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**Basic and Engineering Sciences**

- Branch Specific
- General (Mathematics, Science)

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**Generic Skills**

- Engineering
- Non-Engineering

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Tertiary Engineering Capability Assessment (TECA): Concept Design
Hamish Coates & Alexandra Radloff, Australian Council for Educational Research (ACER)


Instrument Development

Original items proposed by the Consortium

✓ Constructed Response Tasks developed by ACER
✓ Multiple Choice Items proposed by NIER
  Items based on examinations developed by:
  • The Institution of Professional Engineers, Japan
  • Japan Society of Civil Engineers

Engineering Expert Groups

✓ Choosing items from a large pool prepared by the consortium
✓ Modification and verification of items
Main achievements from Japanese side:

• A tangible and substantive understanding of a conceptual framework of engineering competencies and learning outcomes that can be shared globally.

• Concrete and innovative ideas for conceptualizing and measuring competencies and learning outcomes.

• A delightful experience to work on an international team, to learn from global partners, and to be able to make unique contributions.
1. Educational and professional accords for mutual recognition of qualifications and registration in engineering are developing.

2. Several accrediting bodies for engineering qualifications have developed outcomes-based criteria for evaluating programs.

3. Transferability and comparability of degrees of bachelor, master as well as doctor/PhD, across national borders are desired.

Thank you for your attention