Challenges of Teaching Construction Engineering and Management Courses – Hong Kong Experience

Thomas Ng
Associate Head and Professor
Department of Civil Engineering, The University of Hong Kong

Background
Construction-related Programs in HK

- University of Hong Kong
  - Civil Engineering; Surveying; Architecture
- Hong Kong University of Science and Technology
  - Civil & Environmental Engineering
- Hong Kong Polytechnic University
  - Civil & Environmental Engineering; Surveying; Building Engineering and Management
- City University of Hong Kong
  - Architectural Engineering; Civil Engineering
- Chinese University of Hong Kong
  - Architecture

HKU’s Civil Engineering Program

- 4-year credit-based program
  - 240 credits to graduate
- Program structure
  - University common core; engineering core; engineering elective
- Five civil engineering disciplines
  - Structural engineering
  - Geotechnical engineering
  - Environmental engineering
  - Transportation engineering
  - Construction engineering and management
HKU’s Civil Engineering Program

- CEM – undergraduate courses
  - Principles of Civil Engineering Management (core)
  - Construction Project Management (elective)
  - Professional Practice in the Built Environment (elective)
  - Law for Civil Engineers (elective)
  - Management & communication skills for engineers (core)

Course Contents

- Principles of Civil Engineering Management (core)
  - Engineers in society
  - Management theories and practice
  - Financial feasibility study
  - Project delivery method
  - Contractual arrangement
  - Tendering approaches
  - Construction planning
  - Detailed cost estimation
  - Legal issues
  - Dispute resolutions
  - Quality management
  - Safety management
Course Contents

- Construction Project Management (elective)
  - Management of engineering design
  - Value management and lean construction
  - Building information modeling and visualization
  - Sustainability in construction projects
  - Life cycle costing and analysis
  - Prefabrication and off-site construction
  - Financial planning and control
  - Programming, network analysis and critical paths
  - Resource scheduling and time-cost trade-offs
  - Productivity and innovation
  - Contract administration and management
  - Cash flow management

Course Contents

- Professional Practice in the Built Environment (elective)
  - Building control on building planning
  - Statutory requirements in building construction and site supervision
  - Professional conduct, responsibility, liability and indemnity
  - Planning, design and control of tall building structures
  - Seismic design practice
  - Control and practice on foundation construction
  - Means of access for fire-fighting and rescue in building planning
  - Safety planning and management in building projects
  - Control and requirements on health and environment in construction
  - Conservation and re-vitalization of historic buildings
Course Contents

- Law for Civil Engineers (elective)
  - Introduction to legal system and relevant legislation and regulations
  - Rights and obligations of contracting parties
  - Remedies for breach of contract
  - Employer’s protection and remedies
  - Contractor’s remedies
  - Bankruptcy / insolvency of contractor
  - Law of tort for civil engineers
  - Company law
  - Land law and trust
  - Litigation
  - Arbitration
  - Alternative dispute resolution approaches

Masters Program

- CEM – postgraduate courses
  - Building information modelling: Theories and application
  - Sustainable construction technology: principles and practices
  - Building planning and control
  - Urban development management by engineering approach
  - Management of infrastructure megaprojects
  - Project management – human and organisational factors
  - Rights, liabilities and claims in construction contracts
  - Hong Kong, PRC and international construction law
  - Infrastructure contracts management
  - Construction dispute resolution
  - Construction financial management
  - Operation and maintenance of building & civil engineering works
Learning Outcomes

<table>
<thead>
<tr>
<th>Course Learning Outcomes</th>
<th>Relevant HKIE Abilities for Engineering Graduates (Equivalent to Programme Learning Outcomes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Distinguish various construction stages and recognise the roles and responsibilities of professional engineers; select suitable organisation structure for a civil engineering project.</td>
<td>PO(c) an ability to function on multi-disciplinary teams; PO(f) an ability to understand professional and ethical responsibility; PO(h) an ability to understand the impact of engineering solutions in a global and societal context, especially the importance of health, safety and environmental considerations to both workers and the general public.</td>
</tr>
<tr>
<td>2. Evaluate different procurement methods, construction methods, procurement approaches and tendering alternatives; judge what is regarded as ethical behaviour; measure the quantities; recognize the components of tender documents; appraise received tender</td>
<td>PO(p) an ability to identify, formulate and solve engineering problems; PO(f) an ability to understand professional and ethical responsibility.</td>
</tr>
<tr>
<td>3. Evaluate the financial feasibility of a construction scheme; employ the fundamental principle of estimation to derive an unit rate.</td>
<td>PO(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; PO(p) an ability to identify, formulate and solve engineering problems.</td>
</tr>
</tbody>
</table>

Assessment

<table>
<thead>
<tr>
<th>Assessment Type</th>
<th>Percentage of Total Assessment [%]</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous Assessment</td>
<td>30%</td>
<td>Essay type assignment or submission related to the use of a project planning tool - Microsoft Project (or equivalent) and a quiz</td>
</tr>
<tr>
<td>Written Examination</td>
<td>70%</td>
<td>3-hour written examination</td>
</tr>
<tr>
<td>Practical Work</td>
<td>0%</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Course Grade | Description |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Exceptionally good performance demonstrating a superior understanding of the subject matter, a foundation of extensive knowledge, a skilful use of concepts, and ability to analyze and evaluate problems.</td>
</tr>
<tr>
<td>B</td>
<td>Good performance demonstrating capacity to use the appropriate concepts, a good understanding of the subject matter, and an ability to handle the problems encountered in the course.</td>
</tr>
<tr>
<td>C</td>
<td>Adequate performance demonstrating an adequate understanding of the subject matter, an ability to handle relatively simple problems, and adequate preparation for moving on to more advanced work in the field.</td>
</tr>
<tr>
<td>D</td>
<td>Minimally acceptable performance demonstrating at least partial familiarity with the subject matter and some capacity to deal with relatively simple problems, but also demonstrating deficiencies serious enough to make it inadvisable to proceed further in the field without additional work.</td>
</tr>
<tr>
<td>F</td>
<td>Unacceptable performance demonstrating unfamiliarity with the subject matter, and lack of capacity to deal with relatively simple problems, and also demonstrating deficiencies serious enough to make it advisable to retake the course.</td>
</tr>
</tbody>
</table>
Challenges in Teaching & Learning

- Little emphasis on CEM in the program
- Students do not appreciate the importance of CEM knowledge
- Tight teaching schedule for a wide range of topics
- Difficult to explain the practice in classroom
- Text book theories vs. practical experience
- Still heavily relying on examination

Are students competent enough to apply their knowledge to solve “real-world” problems?

Emerging CEM Topics

- Building information modeling
- Sustainability construction
- Industrialization
- Robotics & automation
- New contract form – NEC4
- Asset management
- Big data
Conclusions

➢ CEM knowledge is important to all construction professionals
➢ Related undergraduate programs put less and less emphasis on CEM courses
➢ Students tend to focus more on the technical courses
➢ It is necessary to equip students with novel CEM knowledge to cope with the changes

GLF-CEM Forum has a Major Role To Play in Shaping the CEM Programs and Courses

Thank You

Prof. Thomas Ng
Associate Head & Professor
Department of Civil Engineering
The University of Hong Kong
Email: tstng@hku.hk