

Table 2.1 Knowledge, skills and competences

Superordinate Educational Objectives	Learning Outcomes -Knowledge -Skills -Competence
(a) Knowledge and understanding	Knowledge: <ul style="list-style-type: none"> <li>a1. The graduates have acquired basic knowledge of chemistry, physics, mathematics and computer science needed to understand the phenomena occurring in the field of chemical engineering.</li> <li>a2. They are familiar with the phenomena in chemical engineering, such as chemical reactions and chemical kinetics, energy, mass and momentum transport, thermodynamic equilibrium, phase changes, mixing and fluid dynamics and the most important scientific theories explaining them.</li> <li>a4. The graduates are familiar with the most common methods of chemical analysis and with the basic principles of measurement techniques of process industry.</li> <li>a5. The graduates are familiar with the basics of process control and automation.</li> <li>a6. The graduates know some basics of other engineering disciplines at least at the level of main goals and terminology.</li> <li>a7. The graduates are familiar with basics of industrial economics, e.g. the most common methods for estimation of investment and operation costs and profitability.</li> </ul>
(b) Knowledge management	Skills: <ul style="list-style-type: none"> <li>b1. The graduates can acquire data and information of their field from scientific literature and internet.</li> </ul> Competences: <ul style="list-style-type: none"> <li>b2. The graduates can estimate and check the reliability of information obtained from different sources.</li> <li>b3. The graduates can prepare short scientific reports and documents.</li> </ul>

Table 2.1 Knowledge, skills and competences

Superordinate Educational Objectives	Learning Outcomes -Knowledge -Skills -Competence
(c) Engineering analysis and investigations	<p>Knowledge:</p> <p>c5. The graduates know the main differences between the experimentation at different scales, ie. in laboratory, bench-scale, pilot plant and full scale.</p> <p>Skills:</p> <p>c6. The graduates can carry out simple experiment planning and statistical analysis of experimental results.</p> <p>c7. The graduates can develop mechanistic and empiric models for ideal and /or simple phenomena and processes in chemical engineering.</p> <p>c9. The graduates can use software which is common in chemical engineering and chemistry (e.g. Matlab, Aspen, Balas).</p> <p>c10. The graduates are familiar with the methodology of parallel experimental and computational work. They know the meaning of parameter estimation, model validation and identification of parameter values.</p> <p>Competences:</p> <p>c1. The graduates can identify and define problems with reasonable complexity in their field.</p> <p>c3. The graduates can apply their general and chemical engineering knowledge holistically to solve problems. They understand the advantages of phenomena-based, mechanistic approach in chemical engineering.</p> <p>c4. The graduates can select appropriate methods to solve the problems at hand. These methods are typically experimental or computational (modeling, simulation, experiment planning...), often combinations of them. At bachelor level, however, the problems tend to have limited complexity and width, and the methods are often more approximate and ideal.</p> <p>c8. They are able to use these models in problem solving.</p> <p>c11. They can explain under which conditions the solution has been obtained and what is its range of validity. They also understand that it is important to document this additional information together with the solution.</p>

Table 2.1 Knowledge, skills and competences

Superordinate Educational Objectives	Learning Outcomes -Knowledge -Skills -Competence
(d) Engineering design and development	<p>Knowledge:</p> <p>d1. The graduates know the typical stages and principles of process development and design.</p> <p>d2. The graduates know the usual unit operations and equipment of process industry, as well as their most common selection criteria and design methods. Especially they are familiar with separation technology.</p> <p>d4. The graduates are familiar with principles and methods of process optimization, as well as basic aspects of process intensification and process integration.</p> <p>d6. The graduates are familiar with the typical documents of process design (process diagrams, drawings, specifications, instructions...).</p> <p>d7. The graduates are familiar with concepts and methodology of project work and project management</p> <p>Skills:</p> <p>d3. The graduates can calculate material and energy balances for processes and apply simulation programs in this task.</p> <p>d5. The graduates can define control, measurement and analysis requirements of the process to be designed.</p> <p>d8. The graduates can estimate costs and profitability of products and processes to be designed.</p>
(e) Engineering practice	<p>Skills:</p> <p>e3. The graduates are familiar with the principles of project work and project management. They understand the importance of well planned, goal-driven work where technical and economical goals, as well as timetables are defined and their realization is followed.</p> <p>Competences:</p> <p>e1. The graduates can apply their theoretical knowledge to practical problems. They understand that what is needed in practice is usually a combination of theoretical, experimental and subjective, experience-based knowledge.</p>

Table 2.1 Knowledge, skills and competences

Superordinate Educational Objectives	Learning Outcomes -Knowledge -Skills -Competence
	<p>e4. The graduates are able to take safety and environmental aspects into account in all activities, e.g. in research, design and production.</p> <p>e5. The graduates have been trained to apply their creativity.</p>
(f) Transferable skills	<p>Knowledge:</p> <p>f6. The graduates are aware of the responsibility of their work, its ethical requirements and its influence on society.</p> <p>Skills:</p> <p>f1. The graduates are capable to co-operation and teamwork.</p> <p>f2. The graduates are capable to written and oral communication.</p> <p>f4. The graduates have initiative and they can work independently.</p> <p>Competences:</p> <p>f5. The graduates are competent to adopt new knowledge and they understand that learning is a process which continues through their professional life.</p>

Table 2.2a Knowledge and understanding

Module	a1	a2	a4	a5	a6	a7
BJ70A0001	high	high	moderate			
BJ70A0201	high	high	high			
BJ70A0900	high	high	moderate			
BJ80A1000	high	high				
BM20A0000	high					
BM20A0200	high					
BM20A0400	high					
BM20A0600	high					
BM20A0800	high					
BM20A1401	high					
BM20A1501	high					
BM20A4301	high					
BM20A4310	high					
BM30A0210	high					
BM30A0220	high					
BM30A0230	high					
BM30A0320	high					
BJ70A0102	high	high	moderate			
BJ70A1001	high	high				
BJ80A0400	high	high	moderate			
BJ80A0600	high	high	high			
BH20A0300	moderate	high				
BH20A0700	moderate	high				
BH40A1400	moderate	high				
BJ70A0701	moderate	moderate				
BH40A0250	moderate	moderate				
BJ50A0101	moderate	moderate	moderate			
BJ20A1500		high				
BJ20A1600		high				
BJ20A0700		high				
BJ90A0100		high				
BJ20A1400		moderate	high			
BJ20A0100		moderate				
BJ20A0200		moderate				
BJ20A0800		moderate				
BJ90A0900		moderate				
BJ60A1700					moderate	
BL40A0110			high	high		
BJ30A0302				high	moderate	moderate
BK20A1901				high	moderate	
BJ30A0400				high	moderate	moderate
BJ90A1000					moderate	

Table 2.2a Knowledge and understanding

Module	a1	a2	a4	a5	a6	A7
BJ60A0800			high			
BJ70A0600			high			
BJ70A0701			high			
CS31A0600						high

Table 2.2b Knowledge management

(b) Knowledge management			
Module	b1	b2	b3
BJ70A0102	moderate	moderate	moderate
BJ70A1001	moderate	moderate	moderate
BJ80A0600			moderate
BJ80A0900		moderate	
BJ50A0200	moderate		moderate
BJ20A0700			moderate
BJ20A0100	moderate		
BJ20A0200			moderate
BJ90A0900			moderate
BJ30A0400	moderate		moderate
BJ90A1000	moderate		
BJ60A0800			moderate
BJ70A0600			moderate
BJ70A0701	moderate		moderate
BJ20A1700	moderate		
BJ10A0101	moderate	high	high

Table 2.2c Engineering analysis and investigations

(c) Engineering analysis and investigations												
Module	c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12
BJ70A0201					moderate					moderate	moderate	
BJ70A0900					moderate							
BJ80A1000	moderate			moderate			moderate				moderate	
BM20A1401							moderate					
BM20A1501							moderate					
BJ70A0102	moderate			moderate	moderate							
BJ70A1001	moderate		moderate		moderate						moderate	moderate
BJ80A0400	moderate									moderate	moderate	
BJ80A0600					moderate						moderate	
BJ50A0200				moderate								
BJ20A1500							moderate	moderate				
BJ20A1600							moderate	moderate				
BJ20A0700					moderate							
BJ90A0100									moderate			
BJ20A0100							moderate	moderate				
BJ20A0200					moderate							
BJ90A0900					moderate					moderate	moderate	

Table 2.2c Engineering analysis and investigations

(c) Engineering analysis and investigations												
Module	c1	c2	c3	c4	c5	c6	c7	c8	c9	c10	c11	c12
BJ30A0302		moderate			moderate							
BJ30A0400		moderate										
BJ90A1000		moderate										
BJ60A0800	moderate				moderate	moderate					moderate	
BJ70A0600					moderate					moderate	moderate	
BJ70A0701				moderate	moderate	moderate	moderate			moderate	moderate	
BJ10A0101	moderate			high							moderate	
BJ20A0301								moderate	high			

Table 2.2d Engineering design and development

Module	d1	d2	d3	d4	d5	d6	d7	d8
BJ20A0100		moderate						
BJ30A0400	high	moderate	moderate		moderate	high	high	moderate
BJ30A0302	high	moderate	moderate	moderate	moderate	high	moderate	moderate
BJ20A1500		high	moderate					
BJ20A1600		high	moderate		moderate			
BJ90A0100		high	moderate					
BJ20A1400		moderate						
BJ60A0001		moderate						
BJ60A0900		moderate						
BJ60A1700		moderate						
BJ20A0301			high					
BJ80A0400			moderate					
BJ20A1901						moderate		
CS31A0600								high

Table 2.2e Engineering practice

Module	e1	e3	e4	e5
BJ70A1001	moderate		moderate	
BJ80A0600			moderate	
BJ90A0900	moderate		moderate	
BJ30A0400	high	high	moderate	moderate
BJ90A1000			high	
BJ60A0800	moderate		moderate	
BJ70A0600			moderate	
BJ70A0701			moderate	
BJ30A0302	moderate	moderate	moderate	
BJ80A1000	moderate			
BJ90A0100				
BJ20A0800			high	
BJ70A0900			moderate	
BJ80A0001			moderate	

Table 2.2f Transferable skills

Module	f1	f2	f4	f6
BJ70A0102	moderate	moderate	moderate	
BJ70A1001	moderate	moderate	moderate	
BJ80A0600	moderate	moderate		moderate
BJ50A0200		moderate		
BJ20A0700		moderate		
BJ20A0100	moderate	moderate		
BJ20A0200		moderate		
BJ30A0400	moderate	moderate		
BJ90A1000	moderate	moderate		moderate
BJ60A0800	moderate	moderate		
BJ70A0600	moderate	moderate		
BJ70A0701	moderate	moderate		moderate
BJ20A1700				
BJ10A0101		moderate	high	
BJ60A0900	moderate	moderate		
FV18A1000		high		
BJ20A0301		moderate		
BJ50A0101		moderate		
BJ70A0201		moderate		
BJ70A0900		moderate	moderate	
BJ20A0800				moderate

Note: Outcome f5 is supported by all of the modules.