Metropolia UAS **Biotechnology and Chemical Engineering, Clean Production Technologies 31.1.2024**		extent of credits	Strong engineering skills in mathematics and science	Good interaction skills	Skills to conduct projects	Clean and sustainable production technologies	Know-how for circular economy and sustainable developmen	Clean water production	Efficiency for using materials and energy	**Learning competence**	**Ethical competence**	**Working community competence**	**Innovation competence**	**Multicultural competence**	**Technological competence**
1st Year of study	**Orientation to Biotechnology and Chemical Engineering**	**30**													
	Orientation to Field and Studies	5		x						x	x	x			
	Fundamentals of Chemistry 1	5	x				x			x					
	Introductory Project and Professional Communication	5	x	x	x					x		x	x		
	Engineering English and Communication Skills	5		x						x				x	
	Fundamentals of Engineering Mathematics	5	x							x					
	Fundamentals of Physics	5	x							x					
	Introduction to the Industry	**30**													
	Functions and differentials	5	x							x				x	
	The World of Microbes	5				x	x	x							x
	Fundamentals of Chemistry 2	5	x							x					
	From Raw Materials to Products	5	x				x		x						x
	Analytical and Organic Chemistry	5	x					x		x					x
	Project Course in Biotechnology and Chemical Engineering	5				x	x	x	x	x					x
	In total	60													
2nd Year of study	**Becoming an Expert in Biotechnology and Chemical Engineering**	**30**													
	Engineering Chemistry	5	x						x						x
	Basics of Python Programming	5	x			x	x		x		x				
	Statistics and Design of experiments	5	x						x						
	Fluid mechanics and heat transfer basics	5	x		x	x	x	x	x	x			x		x
	Engineering Physics	5	x							x					
	Properties and Phenomena of Materials	5				x	x	x							x
	Becoming an Engineer in Biotechnology and Chemical Engineering	**30**													
	Process Design Basics	5	x			x			x	x					x
	Health, Safety and Environmental Responsibility	5	x			x	x	x	x		x				x
	Industrial Business	5			x		x			x	x	x		x	x
	Automation Technology	5	x					x							x
	Process Operation Control and Maintenance	5	x			x		x	x		x				x
	Engineering Swedish	5		x						x				x	
	Finnish as a Second Language: Finnish at Work	5		x						x				x	
	In total	60													
3rd Year of study	**Sustainable Production Management**	**20**													
	Modern Production Plant	5	x			x									x
	Ecological Management of Material and Energy Balances	5	x			x	x	x	x						x
	Energy-efficient Production	5	x					x							x
	Sustainable Production	5	x			x		x	x						x
	Designing Future Processes	**30**													
	Physico-Chemical Processing of Renewable Raw Materials	5	x			x									
	Resource-efficient Design of a Modern Production Plant	5	x			x		x							x
	Mechanical Processing of Renewable Raw Materials and P	5	x			x		x							
	Phenomena and Reactors in Biochemical and Chemical En	5	x			x									x
	Future Production Plant	5	x		x	x	x	x	x						x
	Processing of Bio-Based Materials	5	x	x		x		x		x				x	x
	Innovation Project	**10**													
	Multidisciplinary Innovation Project	10	x	x	x		x	x	x	x		x	x	x	x
	In total	60													
4th Year of study	**Bachelor's Thesis**	**15**													
	Bachelor's Thesis	15	x	x	x	x	x	x	x	x			x		x
	Work Placement	**30**													
	Work Placement 1	15		x			x					x	x	x	x
	Work Placement 2	15		x		x	x	x				x	x	x	x
	Elective Studies	**15**													
	In total	60													