Internal Workshop

Master’s programmes’ portfolio renewal

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Aalto University
School of Chemical
Engineering

Purpose of the workshop today

- **Laying foundations for work and discussion in clusters**
- **Identifying core ‘identity’ for clusters (programmes)**
- **Drafting out provisional intended learning outcomes (ILOs) for clusters (programmes)**
- **Agreeing on next steps & their timeline**
- **In short, today marks start of these conversations**

Agenda

12:30 – 12:45	Welcome & introduction to Working in clusters I
12:45 – 13:15	Working in clusters I: identity/’core’
13:15 – 13:30	Brief presentations of cluster work
13:30 – 13:45	Introduction to Working in clusters II
13:45 – 14:00	Coffee break
14:00 – 15:00	Working in clusters II: intended learning outcomes
15:00 – 15:15	Brief presentations of cluster work (3 min/cluster)
15:15 – 15:30	Closing the event & next steps

Recap: Progress so far

- Programme review 2022: Working with our education portfolio
- Meetings with external stakeholders
- Appointment of Cluster Heads
- Appointment of Steering group
- Conversations ongoing on programme, major and application target structure in DPC and KTAK
- Work ongoing/starting in clusters and at department-level

Development of the portfolio in four clusters

Cluster leads nominated by the departments

Biomass refining and advanced lignocellulosic materials
Cluster lead:
Eero Kontturi

- Biomass refining
- Fiber and Polymer Engineering
- N5P in Polymer Technology (discontinuing)
- Biological and Chemical Engineering for a Sustainable Bioeconomy (Bioceb)

Molecular bioscience and Industrial biotechnology
Cluster lead:
Alexander Frey

- Biotechnology
- Biosystems and Biomaterials engineering

Chemical and metallurgical engineering
~~Chemical engineering and circular processes~~
Cluster lead:
Marjatta Louhi-Kultanen

- Chemical and Process Engineering
- Sustainable Metals Processing
- Industrial Energy Processes (Advanced Energy solutions)
- European Mining, Minerals and Environmental Programme (EMMEP)

Chemistry and materials science
~~Chemistry for renewable energy and functional materials~~
Cluster lead:
Kari Laasonen

- Chemistry
- Functional Materials
- Advanced Materials for Innovation and Sustainability (AMIS)
- Master's Programme in Energy Storage

Cluster leads will lead the discussion and development work in the cluster. Responsibility to take forward development actions and participate in portfolio renewal steering group work.

MSc study offerings:
CHEM own offerings
AALTO Joint offerings
International offerings

- International Design Business Management (IDBM) -> (includes compulsory CHEM minor)
- Creative Sustainability CHEM (connects to research focus area 1 & 3)
- Environomical Pathways for Sustainable Energy Systems (SELECT) -> selected courses from all study fields (discontinuing)

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Programme = application target

Draft of the plan for the new structure change from current one big programme to four programmes. Position of international and Aalto joint programmes not included in this. Needs to be decided

Programme "Biomass refining and advanced lignocellulosic materials"

Programme "Molecular bioscience and Industrial biotechnology"

Programme "Chemical and metallurgical engineering"

Programme "Chemistry and materials science"

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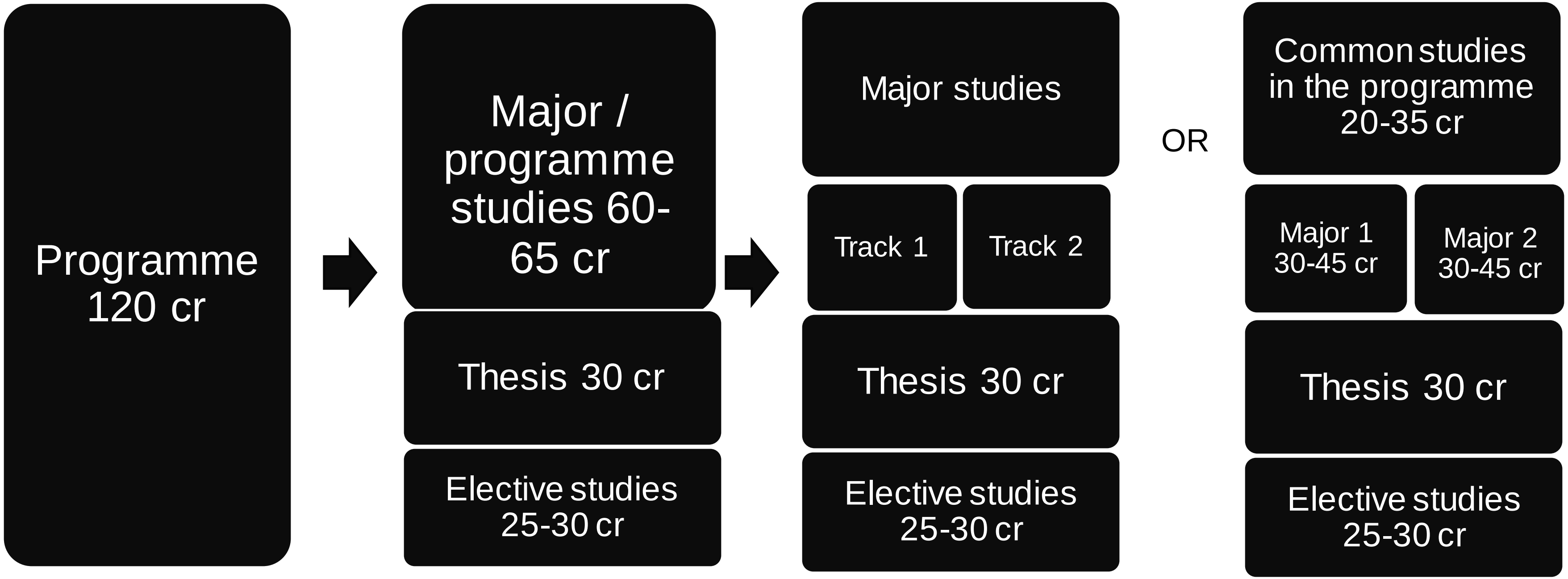
Structure guidelines from Aalto University Degree Regulations

Major studies 40-65 cr, of which at least 30 are for advanced studies

Master’s thesis 30 cr

Elective studies or minor 50-25 cr (if over 30 cr, then minor should be included)

Make-up of new programmes: different models



Same structure in all new programmes

Option 1
Programme= major with specialisation tracks

- Tracks can be more flexible and can consist of different
- Specialisation <u>not</u> visible in degree cert

Major studies

Track 1 | Track 2

Thesis 30 cr

Elective studies 25-30 cr

OR

Option 2
Programme has common studies and specialization in majors

- Specialisation visible in degree certificate

Common studies in the programme 20-35 cr

Major 1 30-45 cr | Major 2 30-45 cr

Thesis 30 cr

Elective studies 25-30 cr

Intro to working in clusters I

- **Task 1:**
  Identifying the core~identity~purpose~uniqueness~strength of each cluster
  [Please pay attention to student/applicant perspective!]
- **Task 2:**
  Identifying tracks/majors = specialisation paths
- **Material:**
  Cluster identities as mapped at Programme Review 18.8.
  Future challenges identified by you Programme Review 18.8.
  Future challenges identified by external stakeholders in Sep

Rooms for cluster work

- **Biomass refining and advanced lignocellulosic materials – KE2**
- **Molecular bioscience and Industrial biotechnology – A303**
- **Chemical and metallurgical engineering - KE3**
- **Chemistry and materials science – KE5**

PLEASE RETURN TO KE2 BY 13:15
TO PRESENT YOUR CONCLUSIONS

Cluster 'identity': Biomass refining and advanced lignocellulosic materials

Cluster 'identity': Molecular bioscience and Industrial biotechnology

Equipping students with an ability to contribute biotechnology-based solutions to a range of different industries while keeping up with an increasingly fast-paced changing world

LifeTech program: working at the interfaces of the sciences

Core identity / unique features of Chemical and metallurgical engineering

- General principles of process design, holistic processing
- Sustainable process design, decreasing environmental footprint
- Skills - industry respects
- Responsible use of natural resources

- Chemical engineering processes, and unit operations
- Process design, operations and control

- Whole value chain of metals processing
- Energy metals and recycling

Cluster ‘identity’: Chemistry and materials science

Graduates are experts in design, synthesis, analysis and application of **molecules and materials**.

Graduates understand the functions of materials from the **atomic and molecular scales** upwards.

Tracks are strongly preferred over fixed majors.
Tentative tracks (1) Chemistry; (2) Materials Science.
Many courses would be shared between tracks.

Intro to working in clusters II

Programme-level ILO's

Designing programme-level ILO's

What constitutes a good programme-level ILO's

Starting work on designing programme-level ILO's

Steps

1. **DEFINE THE PURPOSE AND AIM**
   - The programme aim is written in the programme description. Write the text with the potential student in mind, for it will also serve as a basis for describing the programme to applicants to the study option.
2. **IDENTIFY RELEVANT KNOWLEDGE AND SKILLS**
   - Analyse what learning and skills graduates from the programme should possess: knowledge, skills (also transferrable skills), values and attitudes
3. **DESIGN INTENDED LEARNING OUTCOMES**
   - Formulate the intended learning outcomes of the degree programme

Aligned curriculum: connection between the purpose, ILOs and courses

Our **purpose** is to educate societally conscious engineers

After completing the programme **the graduate will be able to** create, engineer and design societally sustainable and ethically sound technologies, organisations, and businesses.

Courses resonating with the ILO's:

- Societal Design Project
- Advanced Strategic Management
- Leadership and Change Management

Purpose and aim of the programme clarifies why the programme is important and how it responds to the changing needs of the field in the future

Intended leaning outcomes (ILOs) summarise what students should learn and are able to do after graduation

Alignment between **purpose and teaching** is build through ILOs and curriculum mapping

Designing programme –level intended learning outcomes

The starting point for competency-based education is the identification of competencies that are central to the student.

Intended learning outcomes (ILO’s) describe what a student is expected to know, understand, or be able to do after completing a degree programme or course. ILO’s are often expressed as knowledge, skills or attitudes.

How to formulate intended learning outcomes?

After completing the programme the graduate should be able to ✚ **Verb** ✚ **Scientific or artistic knowledge, skill or attitude** ✚ **Context**

Examples:

Our graduate is able to identify the societal context relevant to the water and environment and comprehend the different scales and key drivers applicable to water and environmental engineering.

After completing the programme the graduate should be able to solve complex issues relating to different media, aesthetics, context, expression and conventions, when communicating in narratives, and/or modes like of written language or data.

Characteristics of well-designed programme-level ILOs

Well-designed programme level ILOs:

- **describe** what a graduate is expected to know or be able to do after graduating from the programme.
- **explicate** what the core of the programme is to prospective students and what they can expect from their studies.
- **summarise** the learning usually in no more than 10 ILOs in order to achieve an aligned curriculum with a balanced workload.
- **are open enough** to leave space for course development within the curriculum

Intro to working in clusters II

- **Task 1:**

  Starting the work of mapping cluster-/programme-level ILOs

- **Material:**

  Cluster (and track) identities as identified earlier today

  Existing degree-, programme- and major-level ILOs for each cluster

  If needed, you can find Bachelor-level ILOs at into.aalto.fi/display/fikandchem/Opetussuunnitelma+2022-2024

Rooms for cluster work

- Biomass refining and advanced lignocellulosic materials – E228
- Molecular bioscience and Industrial biotechnology – A303
- Chemical and metallurgical engineering - KE3
- Chemistry and materials science – KE5

PLEASE RETURN TO KE2 BY 15:00 TO PRESENT YOUR CONCLUSIONS AND DON'T FORGET TO HELP YOURSELF TO COFFEE AND CAKE

Cluster ILO'S: Bioproducts engineering

Brief initial ideas:

- **Key topical skills**
  - Fundamental characterisation of biomaterials
  - Conversion and valorisation of biomass
  - Limits and possibilities of sustainable use of biomass as a raw material
  - Understanding the biomass value chain
  - Understanding the use of biostuff for products and applications
  - Understanding and application of biomass chemistry, structure, physics
- **Generic skills**
  - Problem-solving, critical thinking, engineering, communication and leadership skills
  - Product development
  - Disruptive mindset, multidisciplinarity
  - System-level thinking

Cluster ILO'S: Molecular bioscience and Industrial biotechnology

have an in depth understanding of cellular systems at the molecular and cellular level
utilize experimental methods to analyze cellular systems at the systems-level
apply bioanalytical methods to charaterize feedstocks and products
utilize knowledge and experimental skills to genetically modify pro- and eukaryotic cells
sequence-structure-function relationship (protein engineering, enzyme)
experimental methods and computational models
can work alone and in teams on multi-dimensional problems and communicate findings in oral and written form
understand and utilize academic research in defining and approaching problems in systematic and systemic manner
provide students with the language and communication skills needed to follow the scientific development of the field and to engage in scholarly communication in the field of science and technology.

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Cluster ILO'S: Chemical and metallurgical engineering

Our graduate is able:

- To understand the fundamentals of thermodynamics and its role in processes
- Is able to select and design suitable chemical reactors, unit processes and operations for right purpose
- Can optimize process performances based on mass and energy balances
- Can holistically design industrial processes
- Can perform simulations of industrial processes
- Knows the sources of raw materials, their refining/processing unit processes and applications
- Can argue and evaluate sustainability in the context of processes

Cluster ILO'S: Chemistry and materials science

Brief initial ideas:

Student is able to describe chemical structure and properties of molecules and materials using quantum mechanics ~~and thermodynamics~~ across different length-scales.

Student can design, synthesize, analyze and apply molecules and materials to address societal needs (sustainability, industry, academia, third sector, global)

Student can fluently communicate in written and oral form. They can solve complex problems and solve problems in cross disciplinary groups.

Students have soft (reflection, self-regulation, e.g.) and transferrable skills.

Cluster ILO'S: Chemistry and materials science

Brief initial ideas:

- There is strong need of student with good knowledge of chemistry and materials science. Especially in fields of energy storage, molecular synthesis, advanced materials (Canatu, Murata, etc.. Soft matter ?)

Closing the event & next steps

- **Cluster purpose identified and ILO draft from today**
  - ➢ Please submit on Teams (CHEM Education Management / Portfolio renewal 2024-2026 curriculum / Files / CLUSTER WORKSPACES) where you'll find a folder for each cluster
- **ILOs: please continue work in clusters**
  - ➢ Please submit the finalised ILOs in your cluster folder on Teams (link above) **by 12 December 2022**

Next steps

- Introduction Portfolio Renewal website where you can find the project timeline
- Cluster work continues: Your cluster leader will be in touch to arrange meetings
- Forthcoming decision items:
    - Programme structure discussed and finalised Nov-Dec 22
    - Programme names and ILOs discussed and finalised in Jan-Feb 23 DPC & KTAK
    - Programme proposal by Dean to President in Feb-Mar 23

Thank you!

Have a good weekend!

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