

# Design of Biotechnical Process and Production Systems, Project Course

Programme course

6 credits

Projektkurs i design av biotekniska process- och  
produktionssystem

TFTB32

Valid from: 2019 Spring semester

**Determined by**

Board of Studies for Chemistry, Biology  
and Biotechnology

**Date determined**

2018-08-31

**Offered for the last time**

Spring semester 2023

**Replaced by**

TFTB52

## Main field of study

Engineering Biology

## Course level

Second cycle

## Advancement level

A1X

## Course offered for

- Chemical Biology, M Sc in Engineering
- Engineering Biology, M Sc in Engineering

## Entry requirements

Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

## Prerequisites

Industrial biotechnology course is a prerequisite. It is also a prerequisite to attend the following courses that are given in parallel with the course; Biotechnical production systems; Biotechnology manufacturing; Pharmaceutical Development; Quality Management.

## Intended learning outcomes

Project course accomplishing engineering skills in analysis and design of industrial bioprocesses in evaluating production and process economical prerequisites. Understand how to use common process design tools.

## Course content

Follows the specified assignment to the group. This may include total production systems. Raw material supply. Just-in-time principles. Quality systems. Reaction engineering. Unit operations up- and downstream. Process modelling and use of biomechatronic methodology. Process economical evaluation. In-process analysis aspects. Total Quality Management and Process analytical technology (PAT).  
Process validation.

The design shall contain a detailed description of the product and its production. Calculations and modelling of the process operations are a necessity in presenting how the process will behave when implemented. The volumes, batches, yields, material flows and operations shall be presented and scheduled. Process descriptions are presented in flow schedules "hour by hour". Estimations are presented in diagrams and tables.

Economy and resources: The chosen process is calculated based on mass balances, raw materials, operations, investments, personnel etc. The calculations are used to present the financial framework of the process/production over the complete intended time span of the production. Estimations should be presented and explained in tables/diagrams and commented in general text.

Quality management: The needs for quality assessments and controls are presented in reference to the technical and regulatory demands that are integral to the production of the product category.

## Teaching and working methods

The students should in groups of 4-5 persons implement the knowledge presented in the courses on Industrial biotechnology, Biotechnical production systems; Biotechnology manufacturing; Biotechnology and Pharmaceuticals; Quality Management and Engineering. The framework is a project assignment based on industrial design issues within biotech industry. The project model CDIO (Conceive, Design, Implement and Operate) is used. The assignments resemble the work performed by industrial consultancy teams to their customers or at R&D departments of large companies. The projects contain two phases, the first centers in on the conception of the aims and means for the design and the second on development of a process for production. The latter is referred to as the design phase intended to describe the process/production as it is implemented and operated.

The course runs over the entire spring semester. CDIO principles are applied (especially planning, develop, implementing and testing of process solutions). Project groups (4-5 members) are organized and a specified engineering design assignment is allotted to each group which requires the development of group activities based on the curricula in parallel courses.

The course runs over the entire spring semester.

Please note that the courses TMMT03 and TFTB39 should be taken during the same semester as TFTB32.

## Examination

PRA1                      Project                      6 credits                      U, G

Grades are given as 'Fail' or 'Pass'.

## Grades

Two grade scale, older version, U, G

## Other information

Course language is Swedish and the bulk of the literature is in English.

## Department

Institutionen för fysik, kemi och biologi

## Director of Studies or equivalent

Magnus Boman

## Examiner

Gunnar Hörnsten

## Education components

Preliminary scheduled hours: 44 h

Recommended self-study hours: 116 h

## Course literature

Litteratur, checklistor mm från kurserna: Industriell bioteknik, Biotekniska produktionssystem, Bioteknisk tillverkningsteknik, Bioteknik och läkemedel, Offensiv kvalitetsutveckling. Litteratur från egna datasökningar mm i anslutning till projektuppdraget. Referenslitteratur till CDIO-projektet Biomechatronic Design in Biotechnology. Carl-Fredrik Mandenius och Mats Björkman. Wiley 2011. Basic Biotechnology. Colin Ratledge and Björn Kristiansen. 3d edition. Cambridge University Press 2006. Bioseparations Science and Engineering. Second Edition. Roger G. Harrison, Paul W. Todd, Scott R. Rudge, and Demetri P. Petrides. Oxford University Press 2015. In English: Literature from the following courses: Industrial biotechnology, Biotechnical production systems, Biotechnology manufacturing, Biotechnology and Pharmaceuticals, and Quality Management and Engineering Literature acquired through Searches in databases is essential in the development of the projects. Reference literature; Biomechatronic Design in Biotechnology. Carl-Fredrik Mandenius and Mats Björkman. Wiley 2011. Basic Biotechnology. Colin Ratledge and Björn Kristiansen. 3d edition. Cambridge University Press 2006. Bioseparations Science and Engineering. Second Edition. Roger G. Harrison, Paul W. Todd, Scott R. Rudge, and Demetri P. Petrides. Oxford University Press 2015.

## Common rules

### Course syllabus

A syllabus has been established for each course. The syllabus specifies the aim and contents of the course, and the prior knowledge that a student must have in order to be able to benefit from the course.

### Timetabling

Courses are timetabled after a decision has been made for this course concerning its assignment to a timetable module. A central timetable is not drawn up for courses with fewer than five participants. Most project courses do not have a central timetable.

### Interrupting a course

The vice-chancellor's decision concerning regulations for registration, deregistration and reporting results (Dnr LiU-2015-01241) states that interruptions in study are to be recorded in Ladok. Thus, all students who do not participate in a course for which they have registered must record the interruption, such that the registration on the course can be removed. Deregistration from a course is carried out using a web-based form: [www.lith.liu.se/for-studenter/kurskomplettering?l=sv](http://www.lith.liu.se/for-studenter/kurskomplettering?l=sv).

### Cancelled courses

Courses with few participants (fewer than 10) may be cancelled or organised in a manner that differs from that stated in the course syllabus. The board of studies is to deliberate and decide whether a course is to be cancelled or changed from the course syllabus.

### Regulations relating to examinations and examiners

Details are given in a decision in the university's rule book:  
<http://styrdokument.liu.se/Regelsamling/VisaBeslut/622678>.

### Forms of examination

#### Examination

Written and oral examinations are held at least three times a year: once immediately after the end of the course, once in August, and once (usually) in one of the re-examination periods. Examinations held at other times are to follow a decision of the board of studies.

Principles for examination scheduling for courses that follow the study periods:

- courses given in VT1 are examined for the first time in March, with re-

examination in June and August

- courses given in VT2 are examined for the first time in May, with re-examination in August and October
- courses given in HT1 are examined for the first time in October, with re-examination in January and August
- courses given in HT2 are examined for the first time in January, with re-examination at Easter and in August.

The examination schedule is based on the structure of timetable modules, but there may be deviations from this, mainly in the case of courses that are studied and examined for several programmes and in lower grades (i.e. 1 and 2).

- Examinations for courses that the board of studies has decided are to be held in alternate years are held only three times during the year in which the course is given.
- Examinations for courses that are cancelled or rescheduled such that they are not given in one or several years are held three times during the year that immediately follows the course, with examination scheduling that corresponds to the scheduling that was in force before the course was cancelled or rescheduled.
- If teaching is no longer given for a course, three examination occurrences are held during the immediately subsequent year, while examinations are at the same time held for any replacement course that is given, or alternatively in association with other re-examination opportunities. Furthermore, an examination is held on one further occasion during the next subsequent year, unless the board of studies determines otherwise.
- If a course is given during several periods of the year (for programmes, or on different occasions for different programmes) the board or boards of studies determine together the scheduling and frequency of re-examination occasions.

### **Registration for examination**

In order to take an examination, a student must register in advance at the Student Portal during the registration period, which opens 30 days before the date of the examination and closes 10 days before it. Candidates are informed of the location of the examination by email, four days in advance. Students who have not registered for an examination run the risk of being refused admittance to the examination, if space is not available.

Symbols used in the examination registration system:

\*\* denotes that the examination is being given for the penultimate time.

\* denotes that the examination is being given for the last time.

### **Code of conduct for students during examinations**

Details are given in a decision in the university's rule book:  
<http://styrdokument.liu.se/Regelsamling/VisaBeslut/622682>.

### **Retakes for higher grade**

Students at the Institute of Technology at LiU have the right to retake written examinations and computer-based examinations in an attempt to achieve a higher grade. This is valid for all examination components with code "TEN" and "DAT". The same right may not be exercised for other examination components, unless otherwise specified in the course syllabus.

### **Retakes of other forms of examination**

Regulations concerning retakes of other forms of examination than written examinations and computer-based examinations are given in the LiU regulations for examinations and examiners,  
<http://stydokument.liu.se/Regelsamling/VisaBeslut/622678>.

### **Plagiarism**

For examinations that involve the writing of reports, in cases in which it can be assumed that the student has had access to other sources (such as during project work, writing essays, etc.), the material submitted must be prepared in accordance with principles for acceptable practice when referring to sources (references or quotations for which the source is specified) when the text, images, ideas, data, etc. of other people are used. It is also to be made clear whether the author has reused his or her own text, images, ideas, data, etc. from previous examinations.

A failure to specify such sources may be regarded as attempted deception during examination.

### **Attempts to cheat**

In the event of a suspected attempt by a student to cheat during an examination, or when study performance is to be assessed as specified in Chapter 10 of the Higher Education Ordinance, the examiner is to report this to the disciplinary board of the university. Possible consequences for the student are suspension from study and a formal warning. More information is available at  
<https://www.student.liu.se/studenttjanster/lagar-regler-rattigheter?l=sv>.

### **Grades**

The grades that are preferably to be used are Fail (U), Pass (3), Pass not without distinction (4) and Pass with distinction (5). Courses under the auspices of the faculty board of the Faculty of Science and Engineering (Institute of Technology) are to be given special attention in this regard.

1. Grades U, 3, 4, 5 are to be awarded for courses that have written examinations.
2. Grades Fail (U) and Pass (G) may be awarded for courses with a large degree of practical components such as laboratory work, project work and group work.

### **Examination components**

1. Grades U, 3, 4, 5 are to be awarded for written examinations (TEN).
2. Grades Fail (U) and Pass (G) are to be used for undergraduate projects and other independent work.



3. Examination components for which the grades Fail (U) and Pass (G) may be awarded are laboratory work (LAB), project work (PRA), preparatory written examination (KTR), oral examination (MUN), computer-based examination (DAT), home assignment (HEM), and assignment (UPG).
4. Students receive grades either Fail (U) or Pass (G) for other examination components in which the examination criteria are satisfied principally through active attendance such as other examination (ANN), tutorial group (BAS) or examination item (MOM).

The examination results for a student are reported at the relevant department.

### **Regulations (apply to LiU in its entirety)**

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at [http://stydokument.liu.se/Regelsamling/Innehall/Utbildning\\_pa\\_grund-\\_och\\_avancerad\\_niva](http://stydokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva).