COURSE SYLLABUS

Changeable and reconfigurable production systems, 5 credits

Förändringsbara och rekonfigurerbara produktionsystem, 5 högskolepoäng

| Education Cycle: | Advanced level |
| Disciplinary domain: | Technology |
| Subject group: | MT1 |
| Specialised in: | A1N |
| Main field of study: | Production systems |
| Valid from: | - |

Intended learning outcomes:
After a successful course, the student shall

Knowledge and understanding
- display knowledge of changeable, reconfigurable, and flexible manufacturing concepts
- demonstrate knowledge of co-development of products and production systems
- demonstrate knowledge of methods and tools to support design for changeability

Skills and abilities
- demonstrate the ability to conduct development for changeable production solutions

Judgement and approach
- demonstrate the ability to assess current state of implementation and readiness of changeable production systems
- demonstrate the ability to identify need for changeability and reconfigurability

Contents
The course covers development of changeable and reconfigurable manufacturing, in order to enable efficient production of high variety/customization of products, rapid introduction of new products, as well as variations in product volumes. The course includes the following elements:
- Introduction to changeable, reconfigurable, and flexible manufacturing concepts
- Fundamentals of changeability and reconfigurability
- Product and production platforms and co-development
- Changeable production system design and development
- Economic evaluations of changeability concepts
- Virtual support for designing changeable and reconfigurable concepts
- Assessment of readiness and current level of implementation of changeability
- Joint configuration of products and production
**Type of instruction**
Lectures, seminars, and exercises.
The teaching is conducted in Swedish or English.

**Prerequisites**
Passed courses 180 credits in first cycle, at least 90 credits within the major subject Mechanical Engineering, Industrial Engineering and Management or Civil Engineering, and 15 credits Mathematics. English Language requirements corresponding to English A in the Swedish upper secondary school (or the equivalent).

**Examination and grades**
The course is graded Pass or Fail.

Passed grade for all tests are required.

<table>
<thead>
<tr>
<th>Name of the Test</th>
<th>Value</th>
<th>Grading</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise</td>
<td>2,5 hec</td>
<td>P/F</td>
</tr>
<tr>
<td>Seminar</td>
<td>2,5 hec</td>
<td>P/F</td>
</tr>
</tbody>
</table>

**Other information**
If any.

**Course literature**
Literature determines one month before the course starts.
Appendix 1

Subject group, SCB:s
(A selection of groups which JTH has used, consult the study administrator)

**TEKNIK**
BY1 Byggteknik
VV1 Väg- och vattenbyggnad
DT1 Datateknik
ET2 Elektroteknik
IE1 Industriell ekonomi och organisation
KT1 Kemiteknik
MT1 Maskinteknik
TF1 Teknisk fysik
AT1 Automatiseringsteknik
MA2 Materialteknik
TE9 Övriga tekniska ämnen

**NATURVETENSKAP**
FY1 Fysik
KE1 Kemi
MA1 Matematik
MS1 Matematisk statistik
NA9 Övrigt inom naturvetenskap

**JURIDIK OCH SAMHÄLLSVETENSKAP**
IF1 Informatik/Data- och systemvetenskap
FE1 Företagsekonomi
LO1 Ledarskap, organisation och styrning
JU1 Juridik och rättsvetenskap

**HUMANIORA OCH TEOLOGI**
MK1 Medie- och kommunikationsvetenskap
MP1 Medieproduktion

**KONSTNÄRLIGT OMRÅDE**
DE1 Design

**ÖVRIGA OMRÅDEN**
AE1 Arbetsvetenskap och ergonomi
MM1 Miljövård och miljöskydd
Fördjupningskoder, SUHF:s

G1N  grundnivå, har *endast gymnasiala förkunskapskrav*
G1F  grundnivå, har *mindre än 60 hp kurs/er på grundnivå som förkunskapskrav*
G1E  grundnivå, innehåller särskilt utformat examensarbete för högskoleexamen

G2F  grundnivå, har *minst 60 hp kurs/er på grundnivå som förkunskapskrav*
G2E  grundnivå, har *minst 60 hp kurs/er på grundnivå som förkunskapskrav*, innehåller examensarbete för kandidatexamen

A1N  avancerad nivå, har *endast kurs/er på grundnivå som förkunskapskrav*
A1F  avancerad nivå, har *kurs/er på avancerad nivå som förkunskapskrav*
A1E  avancerad nivå, innehåller examensarbete för magisterexamen
A2E  avancerad nivå, innehåller examensarbete för masterexamen

GXX  grundnivå, kursens fördjupning kan inte klassificeras
AXX  avancerad nivå, kursens fördjupning kan inte klassificeras

English translation

G1N  first cycle, has only upper-secondary level entry requirements
G1F  first cycle, has less than 60 credits in first-cycle course/s as entry requirements
G1E  first cycle, contains specially designed degree project for Higher Education Diploma

G2F  first cycle, has at least 60 credits in first-cycle course/s as entry requirements
G2E  first cycle, has at least 60 credits in first-cycle course/s as entry requirements, contains degree project for Bachelor of Arts/Bachelor of Science

A1N  second cycle, has only first-cycle course/s as entry requirements
A1F  second cycle, has second-cycle course/s as entry requirements
A1E  second cycle, contains degree project for Master of Arts/Master of Science (60 credits)
A2E  second cycle, contains degree project for Master of Arts/Master of Science (120 credits)

GXX  first cycle, in-depth level of the course cannot be classified
AXX  second cycle, in-depth level of the course cannot be classified
Tutorial: Objective description for JTH-programmes and courses
(150109 / EcGu, GuJo, CaPa)

Intended Learning outcomes

Intended learning outcomes (ILOs) accumulatively describe a student’s expected knowledge, ability to understand, ability to relate to, and/or to perform, at the end of a certain period of studies. All of the requirements must be fulfilled. The intended learning outcomes must be provided for programmes as well as courses, and can also be provided for parts of courses such as laboratories, assignments etc. The course level intended learning outcomes must be phrased in an examinable manner.

Structure of Intended learning outcomes through categories, verbs, content and quality

All general, programme and course syllabuses at JTH have a common structure with uniform vocabulary. Intended learning outcomes at the programme level is very comprehensive and outcomes at the course level more specific. Number of learning outcomes for the course is held in the table range:

N.B. every course intended learning outcome must be examinable and connected to an appropriate form of examination.
The phrasing of the learning outcomes shall begin with “After X-exam, the student shall” for programme outcomes and “After a successful course, the student shall” for course outcomes.

Each learning outcome is placed in a category and is described by a verb, a content and quality of the outcome. The intended outcome is formulated so that the student is the active party. To facilitate the formulation of outcomes we use different verbs related to the different categories, see JTH’s version of Bloom’s taxonomy in table below.

Categories:

1. Knowledge and understanding, three levels. The learning outcomes shall begin with ”being familiar with”, ”displaying knowledge of”, or ”demonstrate comprehension of”. No other verbs are used in this category.
2. Skills and abilities, three levels. The learning outcomes shall begin with ”demonstrating skills of” or “demonstrating ability to”
3. Judgement and approach, one level. The learning outcomes shall begin with “demonstrating understanding of”.

Normally, there are more learning outcomes in the first category during the first part of the education, and with increased progression towards the end, there are more learning outcomes in the last category.

In category 2 and 3, a verb indicating the expectation level of the student’s performance at the end of the study period (i.e. accounting for, analyzing, constructing, calculating, performing). The verb is also chosen to indicate the level of learning, see table below. In category 1 is not used more verbs than what it says in the introductory phrase to the outcome.
Use one or several words indicating the **content** of the student’s action (i.e. the state of tension in a pipe, the theoretical background to the periodical system, Marx’s philosophy).

Possibly one or several words indicating the **quality** of the expectation level of the student’s performance (eg. detailed, critical, independent, comprehensive, scientific, briefly ...).
Bloom’s Taxonomy adapted for JTH’s Learning Outcome descriptions

<table>
<thead>
<tr>
<th>Category</th>
<th>Knowledge and understanding</th>
<th>Skills and abilities</th>
<th>Judgement and approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Knowledge of specifics</td>
<td>Comprehension</td>
<td>Application</td>
</tr>
<tr>
<td>Description</td>
<td>Having heard/read</td>
<td>Memory</td>
<td>Extrapolation</td>
</tr>
<tr>
<td>Explanation</td>
<td>Recognizing when others describe a principle</td>
<td>Imitating others’ definition of a principle</td>
<td>Explaining a principle via examples of its application in other areas</td>
</tr>
<tr>
<td>The learning outcome begins with …</td>
<td>show familiarity with …</td>
<td>display knowledge of …</td>
<td>demonstrate comprehension of …</td>
</tr>
<tr>
<td>Examples of verbs that relate to particular level of learning</td>
<td>(only the verb in the introductory phrase)</td>
<td>(only the verb in the introductory phrase)</td>
<td>(only the verb in the introductory phrase)</td>
</tr>
<tr>
<td>higher level of learning</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>