Subject title:   **Introduction to hydrometallurgy**

Code (to be filled in by the student administration):

The candidate’s name: NN

Responsible teacher:   Jon Petter Omtvedt

Number of credits (studiepoeng):   10

**Type of teaching** (seminars, colloquium, laboratory course, self-tuition etc.):

Organized teaching is through two seminars arranged on-site at the industry partners of the NFR-BIA Hydromet project. One seminar will be at Yara's factory in Porsgrunn in October and the other one will be one and a half day at Glencore Nikkelverk in Kritiansand, followed by one and a half day at Boliden in Odda. In addition, we have video recordings from a two day teaching seminar arranged at NTNU in March 2016. In addition, we plan a half-day mini-seminar in Oslo in September (lectures by UiO project members). The seminars will include guided tours to the different factories, which should be highly instructive. As part of the seminars the students will be given specific problems to be solved as group work (half a day, one at each site).

There are several students who follow this "special curriculum" course, they will on their own initiative arrange semi-weekly colloquia relevant to the curriculum (the students have already arranged the first colloquium).

The above mentioned seminars will cover most of the curriculum, as specified on the next page.

**Evaluation** (oral/written exam/assignment etc. If the evaluation consists of several parts, it should be stated how much each part contributes to the final grade. It should also be stated whether the evaluation will result in a letter grade or pass/fail. Subjects with more than 5 credits should normally have letter grades):

At the end of the course, and when the student are ready there will be an oral examination in the curriculum, defining a letter (A-F) grade.

Oslo, ……………… …………………………………………..

Responsible teacher

………………………………………………………………………………………………………

Approved by the student administration Date

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DESCRIPTION OF THE CURRICULUM:

**A) Overview of the content (minimum 100 words):**

The curriculum provides a comprehensive overview of chemical processing of metals in water-based solutions – "hydrometallurgy". The metals can take the form of dissolved ions, mineral particles, or metal. The different topics (chapters) covered by the selected course book, as detailed below, is introductory in nature. Each topic could easily be expanded into a book on its own, or even a series of books. Hence, the purpose of this special curriculum, and the selected book, is to give a broad overview of the complete field of hydrometallurgy. Nevertheless the book goes into enough detail to more than justify it to be used at University level teaching in chemistry. The book includes important areas environmental issues and engineering economics.

No such course exits at UiO (or NTNU). This special curriculum is to be regarded as a pilot course funded and organized by NTNU and UiO in unison, and is part of the promised delivery of the NFR-BIA "Hydromet" competence building project. The course book is available online and free of charge from the University Library. 273 pages from the book constitute the curriculum. In addition, hand-outs from the seminars like lecture slides and notes will be part of the total curriculum, estimated to constitute about 50 pages.

**B) Textbooks:**

Author : Title: Publisher/publication year: Syllabus pages:

**Michael L. Free**: *Hydrometallurgy : Fundamentals and Applications*

Wiley ISBN: 9781118230770 (print), 9781118732465 (online) (2013)

* Introduction page 1-18 19
* Chemical fundamentals of hydrometallurgy [[1]](#footnote-1) page 21-61 -
* Speciation and phase diagrams page 65-83 19
* Rate processes page 84-134 51
* Metal Extraction page 137-178 42
* Separation of dissolved metals page 183-214 32
* Metal recovery processes page 218-236 19
* Metal utilization page 239-262 24
* Environmental issues page 264-275 12
* Process design principles page 277-309 33
* General engineering economics page 312-344 33
* General engineering statistics page 348-396 -

Sum pages: 273

1. Most of this chapter is repetition and overlap with the basic chemistry courses required for MSc-students. It cannot be regarded as completely new material (but should be very useful repetition). [↑](#footnote-ref-1)