



## Ansökan projektmedel PUNKTUM

*Denna mall ska du/ni använda för ansökan om medel till 2015 års utlysning av utvecklingsmedel inom **P**edagogisk **U**tveckling av **N**yfikenhet och **K**reativite**T** vid **U**Meå universitet (PUNKTUM).*

*Kursiv text innehåller råd, ger anvisningar och eventuella exempel för respektive avsnitt. Den kursiva texten ska du/ni ta bort och skriva in aktuell text.*

*Rödmarkerad text anger de kriterier som ligger till grund för styrgruppens bedömningar och ska också tas bort i den inskickade ansökan.*

*På PUNKTUM:s hemsida kan du/ni läsa mer om utlysningen, bedömningsprocessen och tidsplanen för PUNKTUM 2015. <http://www.upl.umu.se/projekt/punktum/>*

*För att ansökan ska behandlas ska ansökan vara fullständigt ifylld.*

### 1. Grunddata

#### 1.1 Projekttitel

*Development of an advanced and applied course in electrochemistry with flexible and creative learning.*

#### 1.2 Projektledare

*Ange en person som ansvarar för projektet och dennes kontaktuppgifter.*

Namn: Britta Lindholm-Sethson

E-post: britta.sethson@umu.se

Telefon: 090-7865367

Institution: Kemiska Institutionen

#### 1.3 Underskrift prefekt/enhetschef eller motsvarande

*Undertecknad godkänner projektansökan och medfinansierar med påslaget för gemensamma kostnader.*

Underskrift:

Namnförtydligande:



#### **1.4 Underskrift dekanus**

---

*Undertecknad godkänner projektansökan och medfinansierar med påslaget för gemensamma kostnader.*

Underskrift:

Namnförtydligande:

#### **1.5 Sökt belopp**

---

*Ange totalbeloppet som ni avser söka av PUNKTUM. Pengarna ska i huvudsak användas till arbetstid.*

**245476 SEK**



## 2. Projektbeskrivning

### 2.1 Projektsyfte och bakgrund

*Background:* There is an increasing concern that the subject electrochemistry is fading away from advanced courses at universities around Europe. It is not fashionable and students are scared away from the subject, since it is considered too difficult. However, in-depth understanding of electrochemistry is indispensable in most academic research institutions and industries.

This application takes this into serious account and the main aim with this project is to develop a course in advanced and applied electrochemistry, to attract students from Umeå, Sundsvall and Luleå and also students in a European perspective. At Dep of Chemistry at Prishtina University in Kosovo the competence is high in electrochemistry and Professor Avni Berisha will participate both in course development and later in teaching.

In the development of the course the focus is firstly on presentation of the theoretical part of the material in a comprehensive way to arouse curiosity This will be done through lecture notes and podcasts and bringing in new creative and flexible internet-based strategies for teaching and learning with Problem Based Learning as one important element.

The course will be offered to students at Umeå University primarily at the civil engineering Programmes: *Bioresource Engineering in the fourth year* and *Energy Technology*, as a further development of the 7,5 hp course, 5KE094; "Batteries and Fuel cells". It will also be advertised at the partner universities in Luleå, Sundsvall, Prishtina and other European universities.

*The main objective* is to develop the "*Electrochemical Investigation Course; 15hp*" which will consist of an initial two-week intensive 20-25 hours lecture series on advanced level theories. In this intensive period, tutorials and laboratory excercises are also included. The final part of the course consists of individual research projects or literature studies, where the focus is on individual and creative learning.

*Teaching strategies:* The course will be based not only on traditional lectures and laboratory assignments but also internet-based teaching as an essential option. A possibility to carry out laboratory assignments at the home universities will be provided, if it is not possible for the enrolled students to travel to Umeå.

The bearing idea is to enroll students from three universities in Northern Sweden and several universities around Europe. Competent lectures are invited from Prishtina University in Kosovo, that will match the competence at Umeå University. Lecture notes and podcasts in electrochemistry will be provided in the beginning of the course. This gives an opportunity for students to access the whole lecture series in a flexible way. With weekly scheduled Adobe Connect discussions, a possibility is offered to discuss



upcoming questions directly with the lecturers and co-students. A chat site will be provided for everyday discussions with other students and also the lecturers.

It is certainly anticipated that the accessibility to this type of knowledge and competence will attract students in the Region of Västerbotten and also elsewhere. The direct link to frontier research at Umeå University and partner universities as highlighted in section 2.6, will probably also make the course more attractive.

The possibility to give a course in advanced and applied electrochemistry in combination with relevant application areas within the framework of specific project works is certainly attractive. This is not possible today at Umeå University, since the number of chemistry students is in general too low and in particular those interested in electrochemistry. For instance: At present there is no course in basic corrosion science available at any of the Civil engineering programmes at UmU, which is a severe drawback. The development of the "*Electrochemical Investigation Course; 15hp*" would make a change possible.

The tutorials and project works will be prepared and supervised to inspire the students to become active and curious. It will not be possible "to consume" the course as a passive student. Examination will be based mainly on student activities; i.e: in tutorials, in laboratory excersises, lab seminars and project work. These activities will be based on a PBL, "Problem Based Learning", approach. A small written exam on the theoretical part is considered necessary and will be executed in the middle of the course.

At the end of the course all participants will meet in a 2-3 day workshop where project works will be presented in seminars and as posters. Internationally recognized lecturers will be invited to give lectures. This type of workshop has already been arranged two times with participation of local researchers and international guests.

## 2.2 Projekt mål

The main goal of this project is to develop a course material for a broad course in Electrochemistry, 15 hp, where new pedagogic approaches and examination methods will be included. PBL, "Problem Based Learning" is one of the cornerstones in the pedagogic approach. The course will primarily recruit students from Umeå, Luleå, Sundsvall and Prishtina, but also from other European Universities.

At the end of the project a course material will be prepared consisting of

- 1) a set of lecture notes both as presentation slides and podcasts.
- 2) a catalogue of suitable project works that will be offered to the students in collaboration with the partners in Luleå, Sundsvall, Prishtina and also Deps of Physics and Chemistry at UmU. The project works will be formulated with a PBL approach.

- 3) a set of tutorial questions that illustrates fundamental theory and at the same time highlights the suggested project works.
- 4) Laboratory exercises will be developed with the focus on "open" laboratory assignments. This means that the laboratory exercises should not be based on cook-book recipes but rather based on the creativity and curiosity of the students, where the instructions provide guidelines, inspiration and literature references.

The ultimate aim is to present a general pedagogic approach for advanced courses that will inspire other teachers in their course developments.

As a spinoff effect, we hope to attract a reasonable number of students so the course can be given on an annual basis.

### 2.3 Projektets aktiviteter

Development of course material will be done according to the time schedule in 2.7. The activities are specified below

*Activity 1:* Decision is taken on the framework for the theoretical part and literature references. A draft will firstly be suggested by the main applicant and then brought forward to the partners, who will give input. An Adobe Connect conference will conclude this activity.

*Activity 2:* Initial meetings, face to face, are essential in any collaboration and therefore visits to Prishtina, Luleå and Sundsvall are planned. At these visits the study programmes at the Faculty of Natural Sciences in Umeå will be presented and also relevant research projects and industry. The partners will prepare a similar material to ensure a fruitful discussion. Visits to laboratory facilities and to student groups are also included.

Grants for travelling to Prishtina will be applied for from [http://www.utbyten.se/sv/Program-och-stipendier/Program-A---O/Erasmus-kapacitetsuppgnads/](http://www.utbyten.se/sv/Program-och-stipendier/Program-A---O/Erasmus-kapacitetsuppgnads) and the contact journeys to Sundsvall and Luleå are included in the budget for this grant.

This activity will provide valuable insight for finalising the course material for the first two weeks. It is an important issue to link these introductory weeks to the activities at the partner universities to enhance the possibilities to attract students to the course later.

*Activity 3:* A draft of lecture notes are finalised and sent out to the partner institutions for comments and more input.

*Activity 4:* Decision on a common template for presentation of suggested project works is made. The template is submitted to relevant research leaders in Umeå, Luleå, Sundsvall, Prishtina and possibly other universities, who will write their suggestions to



project works and suitable literature references. Prior to each course, the project suggestions will be updated.

The lead group at the Dep. of Chemistry will assure that the project works will be based on the theoretical knowledge from the first two weeks.

Activity 5: Tutorial questions and laboratory instructions will be developed with the focus on reflecting both the theory and the tentative projects. The main applicant will firstly write suggestions and then discuss with the relevant research leaders/teachers to ensure that the tutorials are in line with their research interest.

Tutorials and laboratory exercises are scheduled for the first two weeks intensive part of the course and will constitute an introduction to the project works and a motivation to acquire the theory.

Activity 6: Final adjustment of lecture notes and preparation of podcasts

#### 2.4 Projektets förväntade effekter

The main applicant is the only lecturer at UmU who has electrochemistry as main subject and will not remain at UmU forever. This course development is a first step to secure a continuation of a high level competence in electrochemistry at UmU. Therefore, a lead group for a sustainable course development is formed, consisting of Professor Britta Lindholm-Sethson, Ass Prof Solomon Tesfalidet and Senior Lecturer William Siljebo.

Future potentiality and transfer of knowledge to other institutions

- 1) It can be envisaged that the pedagogic model for this course will serve as an inspiration for development of other advanced courses at all faculties, where only a small amount of local students are attracted, but where there are excellent lecturers available.
- 2) The lead group is looking forward to a support from UPL during the course development concerning introduction of new pedagogic tools and application of Problem Based Learning. Later, we will participate in seminars at Umeå University to discuss our experiences from course development and later on the implementation.

A continued competence in electrochemistry is one main achievement for the Dep of Chemistry at UmU that will be consolidated through

- 1) An advanced course in electrochemistry that will raise the competence among PhD students and Master students and strengthen the ongoing research at UmU



in fuel cells, solar cells, biosensing etc. It will also consolidate the competence among the involved lectures from the lead group.

- 2) Collaboration with Prishtina University in teaching and student exchange, whereas the competence is high in Electrochemistry there.
- 3) Collaboration with Luleå and Sundsvall, will bring in experience from active research concerning tribocorrosion, supercapacitors, electrocatalysis and Li ion batteries.
- 4) The course will address present research at Umeå University and the partner institutions and therefore serve as a natural gateway for the enrolled students to higher academic achievements with relevant research leaders.

### 2.5 Projektutvärdering

The project will be summarised in a report that will be submitted to Punktum 2016-06-30. The content of the report is described below

- 1) All activities will be described in detail by the main applicant
- 2) Lecture notes, podcasts, tutorials, and laboratory exercises, will be provided both electronically and as written.
- 3) Explanatory notes to course materials directed to students will be included

All participants will reflect on the activities and course materials according to the points below

- a) What was good?
- b) What could have been done differently?
- c) What was learnt?
- d) Is anything missing that has to be added after the project period and before the course starts?
- e) We plan to contribute with seminars to at least two of the “SPA – Seminarserien för pedagogiskt ansvariga”. One seminar should give details on the thoughts and experiences during course development and a second seminar should give insight achieved during the implementation of the course
- f) We plan to publish 1-2 papers describing our experience concerning the pedagogic approach used in this course, in collaboration with for example pedagogues at UPL.

### 2.6 Projektorganisation

#### **Lead group:**

Prof Britta Lindholm-Sethsson will take all responsibilities for keeping deadlines



according to the time schedule and will be convenor for all local meetings and Adobe Connect meetings.

Ass prof Solomon Tesfalidet and Dr William Siljebo will join Britta Lindholm-Sethson in the lead group of the project and take an active part of the course development.

Thus, the following competences are included in the lead group, BLS: Professor in Chemistry with specialization in electrochemistry, ST: Ass professor in analytical chemistry with specialization in trace element analysis and WS: PhD with specialization in electrochemistry.

The following scientists outside the lead group will contribute with ideas to project works and give feedback on lecture notes, tutorial questions and laboratory practices. Prof Johannes Messinger and Prof Jean-Francois Boilly at dep of Chemistry, UmU  
Ass prof Thomas Wågberg at dep of Physics, UmU  
Ass prof Joakim Bäckström at Mid University in Sundsvall  
Ass prof Nazanin Emami at Luleå University of Technology  
Ass prof Avni Berisha at Prishtina University in Kosovo

Senior Lecturers Tomas Hedlund at dep of Chemistry and Robert Eklund at Dep. of Applied Physics and Electronics in Umeå will participate as program coordinators for two engineering programs i.e: the bioresource engineering program and the energy technology program. At present there are only a few electable courses available for the bioresource engineering program and therefore it is anticipated that this course will strengthen the program. For the energy engineers there is a large interest to attend a course that fits their knowledge level and that contains fuel cells and battery technology.

## 2.7 Tidsplan

Course planning and preparation of this course will be performed in the period 2015-08-01 to 2016-03-31 and it will be announced in the spring 2016 to be executed in October 2016 at 100% rate and every year forward.

### Work Schedule

August-September 2015;

*Activity 1:* The framework for the theoretical part and literature is decided. The division of work within the lead group is done.

October-November 2015;

*Activity 2:* Visits to Prishtina, Luleå and Sundsvall. The travel to Kosovo will be financed through Erasmus plus preparatory grants. Travels to Sundsvall and Luleå will be done by car, see budget.

*Activity 3:* Finalising a draft of lecture notes

December 2015 – January 2016:





*Activity 4:* Decision on a common template for presentation of suggested project works. Discussion with the relevant research leaders in UmU, Luleå, Sundsvall, Prishtina and other Universities on possible project works. Writing suggestions to project works for the first course in 2016. The project works will be updated before each course to be up-to-date.

February –March 2015:

*Activity 5:* Tutorial questions and laboratory instructions will be developed that mirrors both the theory and the tentative projects.

*Activity 6:* The lecture notes will be finalised and podcasts will be recorded

The project will be reported to Punktum 2016-06-30

### 3. Budget

The salaries in the budget are mostly based on estimates.

The travel costs to Sundsvall and Luleå are estimates from travelling with car for the lead group and one night in hotel at each visit.

Clarification of budget calculations: GU vh 11,12 is  $UGEM + FGEM + IGEM = 25,2 + 8,0 + 15,8 = 49,0\%$

Ansökan ska lämnas in i pdf-format, och vara inkommen senast kl. 24.00, 17 april 2015.

Ansökan skickas elektroniskt till Registrator via följande e-postadress: medel@diarie.umu.se. I subject/titel/ärenderad i ditt e-brev anger du diarienumret: **FS 2.1.6-1-15**

Originalhandlingarna *undertecknade* av prefekt och dekanus samt eventuellt ordförande i programkommitté skickas med internpost till Registrator, Umeå universitet.