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EH2751 Communications and Control in Electric Power Systems, Project Course

Course Memo

Overview

Development of future power systems requires careful analysis & design of interoperable, secure, robust and high-performing ICT systems that implement the advanced power system control applications needed. The course consists of a large project assignment in which the course participants are required to implement a specific ”Smart” power system function. The project involves analysing requirements, designing a solution and finally implementing the solution. The implementation is based on the components available in the course lab. The course also consists also contains seminars and exercises on project management and planning..

Course Objectives

The purpose of the course is that the students shall be able to independently analyse the needs of advanced ICT based systems for power system control, automation and protection, and also design such systems. The course also provides an overview to the challenges of building so-called Smart power systems. After completing the course, the student shall be able to:

- Independently perform design of advanced functions for power system control and automation based on a set of requirements
- Independently plan and execute a project including requirements analysis and documentation, and design advanced ICT based functions for power system control and automation.
- Implement functions for power system automation and control using predefined components using standardized interfaces. Including programming in the departments lab environment.
- Present the results of the project in a scientific paper as well as perform an oral presentation of the results.
- Evaluate the quality of a completed project

Prerequisites

The following courses, or knowledge gained from similar courses, are pre-requisites for this course.

- EH 2745 Computer applications in Power System, Introductory course

Course limitations

The course is open to a maximum of 12 students; selection will be based on (in order of priority):

1. Grade on course EH2745
2. Total number of ECTS credits achieved
3. Average grade.

Course Structure

The course consists of three parts, Problem Analysis Project planning & execution, and Solution implementation. The course has very few lectures, and is instead based on seminars and individual project supervision meetings. The problem analysis part of the course runs (roughly) during Period 1, and is followed by the Solution implementation part which runs (roughly) during Period 2. The Project planning & execution runs in parallel to the other parts throughout the course duration.

Lectures and Seminars

The Lectures cover mainly course and project structure as well as introduces useful concepts in project planning and execution. The course consists of 5 lectures.

In addition to the lecture, the course has 4 seminars at which students present their work to groups and at some of these seminars also oppose and criticise the work of other groups.

Project Assignment

The core of the course is the project assignment in which the project team is tasked with analysing requirements for an automation function, design a system solution and implement the solution in the department lab platform control of power systems. The project group works independently during the course assisted by the topic supervisors to perform the project. The project assignment is performed as a group assignment, and the groups are expected to work independently.

Course Administration

For course administration and group communication the KTH Social platform is used. KTH Social can be reached at www.kth.se/social. At the course pages for EH2751 in KTH Social, it is possible to download all course material, access information about lectures and seminars and to interaction with students and teachers of the course.

Course updates, schedule changes etc. will continually be posted on the KTH Social platform.

Course Schedule

The course consists of a very limited amount of lectures and seminars. In addition to these sessions, students are expected to book meetings with their topic supervisor for dicussions. In addition, the platform expert is available for meetings in order to resolve in advance any technical difficulties that may arise.

Date, Time		**Description**	**Literature**	
Monday 29 August 13.00 – 15.00 **Q33**	L1	Course Admin • Course Contents • Course structure *Joint for all project courses*		LN
Monday 29 August 15.00 – 17.00 **Cegrellroom**	L2	Project topic introduction • Specific course structure • Project Topic selection		LN
Thursday 1 September 10.00 – 12.00 **Cegrellroom**		**Cancelled**		
Monday 5th September 13 – 15 **K1**	L3	Project Planning		JL
Thursday 8th September	L4	Project Risk Analysis		JL

10 – 12 **M2**				
Thursday 15th September 10-12		**Cancelled**		
Thursday 22nd September 08-12		**Cancelled**		
Monday 26th September 13-15		**Cancelled**		
Thursday 29th September 09 – 12 **Classroom**	Sem	Problem formulation presentation		LN
Monday 3rd October 13 – 15		**Cancelled**		
Monday 10th October 13 – 17		**Cancelled**		
Thursday 13th October 10-12		**Cancelled**		
Thursday 17th October 13-15	Sem	Problem Solution presentation		
Thursday 10th November 10-12 **V3**	Sem	Project Management • Group Dynamics		JL
Thursday 17th November 10-12 **V3**	Sem	Project Management • Group Dynamics		JL
Monday 12th December 13 – 16 **Classroom**	Sem	Project Presentation		LN
Thursday 15th December 09 – 12	Sem	Poster Presentation		LN

Machinelab				

Course Literature

For the project planning and management part of the course, the course book

"Handbook for small projects" Eriksson & Lilliesköld

will be used. It is available in the THS bookstore and online.

For the project topics, the course has no course book, instead for each of the topics, specific reading material is made available on the course web (KTH Social). In addition, students are **strongly encouraged to search for additional reading** with their topic.

Course Grading

The course grades range from A to E and F(ail). The course grade will largely be dependent on the grade on the project assignment. Since the grades will be based on the group's performance, students are encouraged to agree on a level of ambition with regards to grades before forming groups and starting the project. In addition to the grades on the actual project assignment, the students performance in project planning and management will also be graded.

The individual grade in the course, will be determined by the total number of grade points achieved during the course. Grade points are awarded according to the following mechanism:

Problem formulation

The students are asked to analyse the topic chosen, and present the challenges identified through reading up on the provided (and additionally identified) literature. The problem shall then be presented on the Problem formulation seminar.
The presentation of the problem will be awarded from **1-3 grade points**. The amount of points awarded depends on the student's ability to:

- Correctly identify and describe the problem to be solved
- The use of books papers and other sources to describe the problem
- The ability of the students to present the problem at the seminar
- The relation of the problem to other aspects of power system control
- Judge the impact of the problem if not solved on stability and efficiency of the power system

Problem Solution and presentation

The students shall present a solution to the problem identified, the solution shall consider relevant literature provided by the topic supervisors and additional reading identified by the students. The level of sophistication of the solution determines the grade points, but also of course the difficulty of implementation. This solution shall be presented at the Solution presentation seminar. The solution can be awarded **2-5 grade points**. The amount of points awarded depends on the student's ability to:

- Select a proper solution to the problem and propose a control algorithm
- The level of sophistication of the algorithm
- The ability of the students to present the solution at the seminar
- The ability to identify relevant scientific work in the area and use this to formulate the problem

Solution opposition

The students are requested to study the proposed solution by another group, and criticise the solution in order to provide constructive feedback to the solution proposers. The opposing group will be awarded **1-2 grade points**. The amount of points awarded depends on the student's ability to:

- Understand the solution presented
- Ask relevant questions to the proposed solution
- Present their criticism in a constructive manner.

Solution implementation

The proposed solution is to be implemented as a software program in Java interfacing the ARISTO lab platform. The implementation can be awarded **2-5 grade points**. The amount of points awarded depends on the student's ability to:

- Successfully implement the solution in software – running code
- Develop a user friendly application
- Follow principles for good object oriented software development
- Efficiently implement solution algorithms.

Poster Presentation

The solution will be presented to all other project groups at a joint Poster session with all other project groups. This presentation shall be general in nature, accessible to power engineers that do not have specific software skills. The poster and presentation can be awarded **0-1 grade points**. The amount of points awarded depends on the student's ability to

- Present the problem and implemented solution to a general audience
- Create a poster that presents the topic in a easy to read fashion.

Project Presentation

The solution shall also be presented including all technical details to the course examiner and topic supervisor at a final seminar. The presentation can be awarded **1-2** grade points. The number of points awarded depends on the student's ability to:

- Present problem and how the solution addresses the problem
- Present the structure of the solution and its limitations
- Defend the solution during the discussion

Scientific paper

The results of the project including the problem definition and implementation in the platform including conclusions about the quality of the solution shall be documented in a scientific paper 6-8 pages long following the IEEE format. The paper can be awarded from **1-3 grade points**. The amount of grade points is determined by

- Clarity of presentation
- Quality of language
- Level of rigour in analysis and presentation of problem
- Clarity of presentation of implementation and solution.

Project grading

The grade point range for the project work is

Up to 8 Grade points	Fail
8 grade points	E

Up to (and including) 10 grade points	D
Up to (and including) 13 grade points	C
Up to (and including) 16 grade points	B
19 Grade points and above	A

Project Planning & Management
The project planning & management part of the course is graded separately, and consists of two components

Project plan & risk analysis
The project plan and risk analysis is created as a document at the outset of the project, and should be used by the students through out the project to track use of resources, timing of events as well as manage risks during execution of the project. Students can be awarded **1-4 grade points** for project execution. The amount of grade points awarded depends on:

- Quality of the project plan in relation to template & instructions
- The soundess of plans regarding timing and use of resources
- The use of the project plan throughout the project in management of the project
- The assessment of risks and mitigation of risks during project execution.

Group Dynamics
Participation in the group dynamics exercise is awarded with **1 grade point**.

Project grading
The grade point range for the project work is

0 grade points	Fail
1 grade points	E
Up to (and including) 2 grade points	D
Up to (and including) 3 grade points	C
Up to (and including) 4 grade points	B
5 Grade points and above	A

Total course grade:

Up to 5 Grade points	Fail
7 grade points	E
Up to (and including) 10 grade points	D
Up to (and including) 14 grade points	C
Up to (and including) 18 grade points	B
22 Grade points and above	A

Course Teachers

Course Responsible & Examiner:	Prof. Lars Nordström (LN)
Lecturer	Assoc. Prof Joakim Lilliesköld (JL)
Supervisors:	Mohammad Hassan Fidai Georgii Valdenmeier Davood Babazadeh Jan-Henning Jurgensen Daniel Brodén Wu Yiming
Platform expert:	Mohammad Hassan Fidai (HF)
Course locations:	All located at Osquldas väg 10