COURSE ANALYSIS, postgraduate course

Third cycle courses, EECS School, KTH , from 2018

An asterix (*) denotes non-compulsory data.

Course data

Course name	Selected Topics on Emerging Information Technologies for Industrial Digitalization
Course ID	FEO3290
Credits	8.0 hp
Credits per module	
Time period for course	**P1, P2, 2021 (September—December, 2021)**
Teachers	Zhibo Pang, Ming Xiao
Examiner	Ming Xiao
Classroom hours	14x2, there are 28 hours of lectures plus also student presentations, for which each student presentation takes about 30 minutes.
Nr of registered students	30 (12 KTH students and 18 non-KTH students)
Examination rate, in %	25 students passed so far, including 8 KTH students and 17 non-KTH students passed

Goals

Global course goals	With the development of various enabling technologies, e.g., AI, 5G and beyond, industry security, digital twin, global coverage and edge computing, the digitalization of industries has attracted lots of research efforts and started to be deployed in various industry scenarios. Though some courses may involve a part of those topics, a comprehensive and vertical-application oriential course have not been developed. Moreover, a systematic study on requirements, challenges and development of information technologies for industry digitalization has not been developed yet. This course aims to address these problems by developing systematic and vertical-application oriented course for industry digitalization. The main objectives of the course are to train the students on the key information technologies for industry digital transformation and to inspire the students for potential new research topics. After the course, the students should be able to: 1. Present an overview of and the technical requirements for industry digitalization. 2. Describe the information technologies for sustainable industries. 3. Describe key requirements and enabling technologies of information technologies (both theories and practices) for industry digitalization, including e.g., wireless networks, AI, security, digital twin and global coverage etc. 4. Explain how the information technologies are applied in vertical use cases for industry digitalization. 5. Explain recent development and existing challenges of information technologies for industry digitalization.
How the course design helps fulfill these goals	The course design includes course content, teaching method and examination. The course content includes the most important information technologies for industry digitalization e.g., high-performance networks, industry

	AI, robots, digital twin, cloud/edge computing, industry safety/security and global coverage. Moreover, the course includes both theoretical knowledge from recent textbooks and publications and also the first-hand knowledge (knowhow) from industrial practices. Nearly a half of the lectures were designed and taught by Zhibo based on his research findings in the past ten years at ABB Corporate Research on wireless communications, artificial intelligence, and edge/cloud computing for the industrial digitalization. Those contents cover most of the important vertical scenarios of industrial digitalization such as buildings/infrastructure automation, factory automation, process automation, industrial robotics, service robotics, power systems, and power grids. There are often open-ending for lectures, i.e., open challenges and promising/prioritized research directions are given to inspire new research. The teaching methods include lectures by teachers, student presentations, survey reports by students, and quiz & answer/discussing during classes. To pass the course, the students are required to attend at least 80% of the meetings (11 or more out of 14 meetings), and the students should also finish survey reports (about 4 pages each) and oral presentations. Based on questionnaire from students, the course objectives are achieved.

Pedagogical development - I

***Changes made* since previous time course was given**	Not relevant. This is the first time to give the couse.

Course evaluation; comments from students

Based on the anonymous questionnaire.

Evaluation response rate	50%. 30 questionaires were sent out and 15 were fed back.
Overall student view*	The overall comments are very positive. From 15 feedback, 9 students are very positive and 5 positive and 1 neutral (out of the scale of negative, neutral, positive and very positive). Students enjoy the course and found the course fruitful for them. Students think the course should continue in future.
Positive comments	1. I like the discussion part during the lecture, it gives us time to think and reflect on the course content. 2. I think they (Quiz and discussion) are very necessary and helpful. 3. I think the included topics are very sufficient and wide enough to cover many areas from different fields. 4. Very interesting topic relevant for my work. Especially wireless communication and safety aspects. 5. I like the large number of journal articles referenced. Gives good knowledge of the topics 6. the course reflects the latest progress of information technologies in industrial digitalization, fills the gap between academia and industry, and contains extensive knowledge, materials, best practices and trend of the industry.

	7. Almost all parts were very interesting to me. 8. In general, I like my slides to be more visual and well designed by videos and animations.
Negative comments	1. Personally, I do not like the student's presentation parts, or we should know the student presentation topics before. 2. If canvas access can be made easier it would be ideal. 3. Limited time duration, since sometimes the content of lecture is ample. 4. maybe we can shorten this (machine learning) part, I guess most of us have some kind of knowledge of ML now days. 5. The only thing I could mention was to have sessions without break. Sometimes a short break is needed. 6. Perhaps, the lecture can be like a workshop where the group of students choose one particular topic and discuss it in front of their classmates.
Pre-knowledge, comments*	No spefific comments on pre-knowledge.
Course design, comments*	1. I think they (Quiz and discussion) are very necessary and helpful.
Literature, comments	1. Topics and literature are well aligned. 2. Good coverage of literature. 3. Well-selected topics and representative literatures.
Examination, comments	1. Student presentation is a good idea and also survey report is good for me to focus on specific topics.
Particularly interesting* comments	1. I think the work load is relatively small for a 8.0 credits course. Maybe some other small assignments should be added in addition to the final essay. 2. If the course has one day for visiting any specific application to see how real application works, e.g. in ABB, then it is perfect. 3. It was better to allocate more time for the discussion part after the main lectures and student lectures. Also, discussion during the lesson makes it very interactive. 4. Topics related to Blockchain applications can be included.

Course teacher's impressions from the evaluation

Comments	The comments are generally positive and many of them are valuable. For instance, a few students suggested assignments/projects by a team of students may be useful for future teaching. A few non-KTH students complained on Canvas access (they are not familiar with). Two students suggested that blockchain related topics should be included.

Course teacher's summary

Overall view	In general, the courses are well received and well attended. It has motivated and engaged students in general. Students are active in participating lectures and presentation. Oral presentation made students somehow updated to the most recent research as well. The survey reports by them also reflects engaged works.
Positive comments	Students are in general active. Many of them like the discussion parts during classes.
Negative comments	No specific negative comments.
View on pre-knowledge*	No specific comments. We believe students in general EECS areas can particiate without specific pre-knowledge is needed.
View on course design*	Students like the teaching methods in general. Especially, they like quiz and dicussion parts (for interactive teaching). They also like presentation and survey. Thus, they may get feedback from teachers or other students on their own works. 90 minute lectures without breaks may be a bit challenging for some students. A short break may be better.
View on course material	
View on examination	

Pedagogical development - II

***Outcome of course changes made* since last time course was given**	Not relevant
***Changes to be made* before next time course is given**	Some team work (some project) may be added in future work

Other

Comments*