Sungkyunkwan University (SKKU) International Summer Semester (ISS) 2022

The 4th Industrial Revolution: Technologies and Practices

SHORT COURSE DESCRIPTION

Standing on the brink of a technological revolution, mankind is facing the transformation unlike anything has experienced before. The first Industrial Revolution used water and steam power to mechanize production. The second Industrial Revolution utilized electrical power for mass production. The third Industrial Revolution used electronics and information technology to establish connectivity. Now the fourth Industrial Revolution comes, which is being built on the third by integrating futuristic technologies with much greater scope and velocity. Compared to the previous industrial revolutions, the fourth one is evolving at an exponential speed with complexity. This course will discuss about the 4th Industrial Revolution technologies and practices with regard to potential changes and impacts on our industry and society. Course topics for primary technologies and practices include data science, machine learning, artificial intelligence, intelligent robots, internet of things, 3D printing, big data, smart factory, and cloud computing in the domains of manufacturing, logistics, wholesale, and retail industries. Each topic will discuss practical and innovative applications. We will consider challenges and opportunities for the forthcoming totally different environments that the 4th Industrial Revolution will bring in as an enormous flow. We need to strategize the forces of disruption to shape our future to constructive and productive directions.

READING MATERIALS

Reading materials will be provided in advance during the course. All the lecture notes and other course materials will be provided in the class. Background readings include:

1. 4th Industrial Revolution, World Economic Forum (2022). https://www.weforum.org/
2. The Fourth Industrial Revolution: what it means, how to respond, Klaus Schwab (2016). https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/
3. The 4th Industrial Revolution Is Here, Forbes (2018). https://www.forbes.com/sites/bernardmarr/2018/08/13/the-4th-industrial-revolution-is-here-are-you-ready/#9f18b05628b2
4. The Fourth Industrial Revolution, Encyclopedia Britannica (2019). https://www.britannica.com/topic/The-Fourth-Industrial-Revolution-2119734

COURSE REQUIREMENTS AND GRADING

Attendance and active participation in class is very important for the completion of the course. Open discussions are encouraged and will be arranged on suitable topics. Academic dishonesty, plagiarism, poor team work, and less than 80% attendance (without prior notice and professor's consent) leads a student to fail.

CRITERIA	ATTENDANCE	EXCURSION	CASE STUDY	PRESENTATION	GROUP WORK	INDIVIDUAL WORK
WEIGHT	10%	15%	30%	20%	15%	10%
NOTE	< 80 % FAIL	Preparation, participation & presentation	Based on the topic Innovating smart collaborations and revolutions around the world	Case study and other presentations	Group assignments	Individual assignments

COURSE SCHEDULE

– WEEK I –

Monday (27 June)

Introduction
What is the 4th Industrial Revolution?
Review of previous industrial revolutions
Impact of the 4th Industrial Revolution
Primary technologies for the 4th Industrial Revolution

Tuesday (28 June)
Data science:
- Purpose and roles of data science for the 4th Industrial Revolution
- Computing engine and analytics
- Analytics tools – R, Python, Stata, Scala, SAS, etc.

Wednesday (29 June)
Data science (continued):
- Data structures
- File import/export
- Data cleaning and data wrangling
- Practical applications

Thursday (30 June)
Machine learning:
- Overview and theoretical foundations
- Descriptive, predictive, and prescriptive analytics
- Machine learning algorithms: supervised and unsupervised
- Clustering
- Naïve Bayes

– WEEK II –

Monday (4 July)
Machine learning (continued):
- Decision tree
- Regression
- Practical applications

Artificial intelligence
- Overview and relationships to other technologies
- Practical applications

Tuesday (5 July)
Intelligent robots:
- Linkage to artificial intelligence
- Practical applications – industry robots, humanoids

Wednesday (6 July)
Internet of things:
- Sensors, devices, and networks for track and trace
- Ubiquitous connectivity
- Security and privacy
- Interoperability and standards
- Practical examples
  - Manufacturing industry
  - Logistics industry
  - Wholesale industry
  - Retail industry – auto insurance

Thursday (7 July)

Internet of things (continued):
- Practical applications

Role play for hot issues of the 4th Industrial Revolution

– WEEK III –

Monday (11 July)
3D printing:
- Computer-aided design (CAD)
- 3D modeling and printing
- 3D printing processes
- Practical applications

Teams/Groups Division
- Preparation for next day's Excursion

Tuesday (12 July)
Industrial Revolution Excursion:
- How much aware we are?
- Spreading Awareness

Wednesday (13 July)
Group Discussion about the excursion
- Discussion on the excursion and experience

Innovation workshop

Big data:
- Scope and tools
- Big data processing – architecture, technologies
- Hadoop distributed storage system
- Spark computing engine
- Practical applications

Thursday (14 July)
Smart factory:
- Visibility, connectivity, and autonomy
- Relationships with other technologies – robots, machine learning, data science, big data, Industrial IoT
- Practical applications

Students Case Study prep
- Innovating through collaboration
- Smart revolutions and projects around the world

Friday (15 July)
Cloud computing:
- Cloud service types – SaaS, PaaS, IaaS
- Cloud and IoT
- Hybrid cloud computing
- Pros and cons
- Adoption strategy
- Practical applications

– WEEK IV–

Monday (18 July)

Other 4th Industrial Revolution related technologies

- Block chain
- Digital health

Students Presentations – I

Tuesday (19 July)

Students Presentations – II

Final Remarks/discussions and Wrap-up