

Course Syllabus

| | |
|--------------------------------|--|
| 1. Course Number | 5698101 |
| 2. Course Credit | 3 Credits |
| 3. Course Title | Emerging Technologies for Lifelong Learning |
| 4. Faculty / Department | School of Integrated Innovation, Chulalongkorn University |
| 5. Semester | Second semester |
| 6. Academic Year | 2023 (Spring 2024) |
| 7. Instructor / Academic Staff | Poomjai Nacaskul |
| 8. Condition | None |
| 9. Status | Required |
| 10. Curriculum | Bachelor of Arts and Science in Integrated Innovation (International Program) |
| 11. Degree | Undergraduate, First Year |
| 12. Hours / Week | 3 Hours |
| 13. Course Description | |

This is a Directed Self-Learning/Seminar-based course designed to awaken students to an ever-evolving set of emerging technologies likely to have the greatest impacts on their professional lives over the coming decades---ranging, *inter alia*, from Quantum Computing to Human-Machine Interface, Optimal Control and Cybernetics, from Computational Bioinformatics to Nanotechnology, Nanobots, and Soft Robotics, from Renewable Energy to Ecological Rehabilitation Technologies, and so on. The course aims to equip students with life-long self-learning *skills*, ignite their *passion* for intellectual pursuits, bring to *realisation* their roles and responsibilities in harnessing the power of technologies to affect positive changes, and perhaps hone their *instinct* to anticipate and thus prepare for far-flung technological disruptions yet to materialise in the distant future. A major component of the course is the introduction to and use of Mathematica software to visualize and experiment with the statistical-computational models underlying said emerging technologies. Students will be asked to view online video documentaries, survey the technical-scientific publications on which the documentaries are based, and when possible, write Mathematica applets to demonstrate the learned concepts.

14. Course Outline

14.1 Learning Objectives / Behavioral Objectives

By the end of course, students should be able to do the following:

| Learning/Behavioral Objectives | | | | |
|--------------------------------|--|--|---|--|
| No. | Behavioral Objectives | Learning Outcomes | Teaching Methods/ Developments | Evaluation Methods |
| 1. | awakened to an ever-evolving set of emerging technologies likely to have the greatest impacts over their professional lives (i.e. 10-20 years post-graduation) | 1.1 Possessing well-rounded knowledge 2.1 Being moral and ethical 3.2 Being able to think creatively | 1. Lecture 3. Seminar 16. Program, Computer assisted lesson, Hybrid learning, Online learning | 1. Written exam 7. Assignment evaluation 8. Report/Project evaluation 11. Critical/Presentation evaluation 16. Verbal presentation 17. Class attendance |
| 2. | passion to explore and perspective to anticipate, appreciate, and prepare for future technological disruptions | 4.2 Having communication skills 4.3 Having skills in information technology 5.1 Having an inquiring mind 5.2 Knowing how to learn | 23. Independent study 29. Collaborative learning 32. Brainstorming 33. Summary or Presentation of the assigned search topic 39. Self-learning | 1. Written exam 7. Assignment evaluation 8. Report/Project evaluation 11. Critical/Presentation evaluation 16. Verbal presentation 17. Class attendance |

14.2 Learning Contents/ Learning Schedule

| # | Date | Contents | Lecturer |
|---------|-----------|---|--------------------|
| 1 | 9-Jan-24 | New Model of/Perspective on Learning Mathematics, Liberal Arts, and Scientific Discipline | Poomjai Nacaskul |
| 2 | 16-Jan-24 | Learning from/Lessons of Technological Innovations, Sufficiency Economy Philosophy & Sustainable Dev | Poomjai Nacaskul |
| 3 | 23-Jan-24 | Intro to Wolfram Mathematica as Tool for Interactive Learning/Prototyping/Visualisation/Experimentation | Poomjai Nacaskul |
| 4 | 6-Feb-24 | Intro to Nanotechnology & Material Science 1 | Dr. Louis Hornyak |
| 5 | 7-Feb-24 | Intro to Nanotechnology & Material Science 2 | Dr. Louis Hornyak |
| 6 | 20-Feb-24 | Intro to Genomics/Transcriptomics/Proteomics 1 | Dr. T. Saithong & |
| 7 | 21-Feb-24 | Intro to Genomics/Transcriptomics/Proteomics 2 | Dr. S. Kalapanulak |
| 8 | 27-Feb-24 | Project Workshop 1 | Poomjai Nacaskul |
| Midterm | | | |

| | | | |
|-------|-----------|--|--------------------|
| 9 | 26-Mar-24 | Intro to AI, Robotics & Autonomous Vehicles 1 | Dr. T. Slanvetpan, |
| 10 | 2-Apr-24 | Intro to AI, Robotics & Autonomous Vehicles 2 | <i>et al.</i> |
| 11 | 12-Mar-24 | Intro to Bitcoin & Blockchain | Poomjai Nacaskul |
| 12 | 19-Mar-24 | Intro to Cryptography & Intro to Satellite Imaging/GIS | Poomjai Nacaskul |
| 13 | 9-Apr-24 | Intro to Quantum Computing | Poomjai Nacaskul |
| 14 | 10-Apr-24 | Project Workshop 2 | Poomjai Nacaskul |
| 15 | 23-Apr-24 | Project Presentation | Poomjai Nacaskul |
| Final | | | |

14.3 Method

- Lecture 30 %
- In Class Seminar/Group Discussion 30 %
- Project work/Term paper 40 %

14.4 Media

- Mathematica Notebook
- PDF excerpts
- Mindmaps
- YouTube videos

14.5 Assignment through Network System

- 14.5.1 Assigning and Submitting Method: MyCourseVille
- 14.5.2 Learning Management System: MyCourseVille

14.6 Evaluation

- 14.6.1 Assignments (homework, term project/report) 60-80 %
- 14.6.1 Examination 10-20 %
- 14.6.2 Participation 10-20 %

15. Reading List

15.1 Recommended Text

- [1] Parsons, Lin & Cockerham (2019), *Mind, Brain and Technology: Learning in the Age of Emerging Technologies*, [Springer], [ISBN: 978-3-030-02631-8].
- [2] Zhu, Xiaoming (2019), *Emerging Champions in the Digital Economy: New Theories and Cases on Evolving Technologies and Business Models*, [Singapore: Springer], [ISBN: 978-981-13-2628-8].
- [3] Tobji, et al. (2018), *Digital Economy: Emerging Technologies and Business Innovation*, [Springer], [ISBN: 978-3-319-97749-2].

- [4] Weinersmith, K. & Weinersmith, Z. (2017), *Soonish: Ten Emerging Technologies That'll Improve and/or Ruin Everything*, [Penguin Press], [ISBN: 978-0-399-56382-9].
- [5] Ge, Ifenthaler & Spector (2015), *Emerging Technologies for STEAM Education: Full STEAM Ahead*, [Springer], [ISBN: 978-3-319-02573-5].
- [6] Follett, Jonathan (2015), *Designing for Emerging Technologies: UX for Genomics, Robotics, and the Internet of Things*, [O'Reilly Media], [ISBN: 978-1-449-37051-0].

15.2 Supplementary Texts

- [7] Rajendran, et al. (2019), *Innovative Food Science and Emerging Technologies: the Science behind Health*, [Apple Academic Press], [ISBN: 978-0-203-71140-8].
- [8] Sejnowski, Terrence J. (2018), *The Deep Learning Revolution: Machine Intelligence Meets Human Intelligence*, [Cambridge, MA: The MIT Press], [ISBN: 978-0-262-03803-4].
- [9] Le, et al. (2018), *Emerging Technologies for Health and Medicine: Virtual Reality, Augmented Reality, Artificial Intelligence, Internet of Things, Robotics, Industry 4.0*, [Salem: John Wiley & Sons], [ISBN: 978-1-119-50981-3].
- [10] Dezotti, Lippel & Bassin (2018), *Advanced Biological Processes for Wastewater Treatment: Emerging, Consolidated Technologies and Introduction to Molecular Techniques*, [Springer], [ISBN: 978-3-319-58834-6].
- [11] Modjarrad, K. & Koff, W.C. (2017), *Human Vaccines: Emerging Technologies in Design and Development*, [Academic Press], [ISBN: 0-128-02542-5].
- [12] Goyal, Megh R. (2017), *Emerging Technologies in Agricultural Engineering*, [Apple Academic Press], [ISBN: 978-1-77188-341-2].
- [13] De Feo, De Gisi & Lofrano (2012), *Green Technologies for Wastewater Treatment: Energy Recovery and Emerging Compounds Removal*, [Netherlands: Springer], [ISBN: 978-9-400-71430-4].
- [14] Jacko, Julie A. (2012), *Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies, and Emerging Applications*, [CRC Press], [ISBN: 1-439-82944-6].

15.3 Research Articles/Academic Articles (seminal papers, papers by lecturer)

- [15] Nacaskul, Poomjai (2010-2020), *Papers/Presentations*, [https://www.researchgate.net/profile/Poomjai_Nacaskul3].

- 15.4 Electronic Media or Websites [[www.youtube.com/channel/...](http://www.youtube.com/channel/)].
- [16] Wilde, Julia (2012-), *Seeker*, [[.../UCzWOYUVCpZqtN93H8RR44Ow](https://www.youtube.com/channel/UCzWOYUVCpZqtN93H8RR44Ow)].
- [17] sensu.org (2011-), *Sensu*, [[.../UCirPAjwBB4inJ6sPuM0Lx0g](https://www.youtube.com/channel/UCirPAjwBB4inJ6sPuM0Lx0g)].
- [18] Borlace, Dave (2018-), *Just Have a Think*, [[.../UCRBwLPbXGsl2cJe9W1zfSjO/videos](https://www.youtube.com/channel/UCRBwLPbXGsl2cJe9W1zfSjO/videos)].
- [19] Muller, Derek (2010-), *Veritasium*, [[.../UCHnyfMqiRRG1u-2MsSOLbXA](https://www.youtube.com/channel/UCHnyfMqiRRG1u-2MsSOLbXA)].
- [20] Zsolnai-Fehér, Károly (2006-), *Two Minute Papers*, [[.../UCbfYPyITO-7l4upoX8nvctg](https://www.youtube.com/channel/UCbfYPyITO-7l4upoX8nvctg)].
- [21] Sanderson, Grant (2015-), *3Blue1Brown*, [[.../UCYO_jab_esuFRV4b17AJtAw](https://www.youtube.com/channel/UCYO_jab_esuFRV4b17AJtAw)].
- [22] Quantamagazine (2015-), *Quanta Magazine*, [[.../UCTpmmkp1E4nmZqWPS-dl5bg](https://www.youtube.com/channel/UCTpmmkp1E4nmZqWPS-dl5bg)].
- [23] Business Insider (2015-), *Science Insider*, [[.../UC9uD-W5zOHOUAVT2GdclCvg](https://www.youtube.com/channel/UC9uD-W5zOHOUAVT2GdclCvg)].
- [24] AAAS (2008-), *Science Magazine*, [[.../UCv0aU2eKry3kdSTnFa8OAWA](https://www.youtube.com/channel/UCv0aU2eKry3kdSTnFa8OAWA)].
- [25] McManus, Brian (2013-), *Real Engineering*, [[.../UCR1luLEqb6UEA_zO81kwXfg](https://www.youtube.com/channel/UCR1luLEqb6UEA_zO81kwXfg)].
- [26] Shillito, Paul (2011-), *Curious Droid*, [[.../UC726J5A0LLFRxO0SZqr2mYO](https://www.youtube.com/channel/UC726J5A0LLFRxO0SZqr2mYO)].
- [27] Wired Magazine (2005-), *Wired*, [[.../UCftwRNsifRo08xYE31tkiyw](https://www.youtube.com/channel/UCftwRNsifRo08xYE31tkiyw)].
- [28] Posner, et al. (2014-), *Vox*, [[.../UCCLXo7UDZvByw2ixzpOCufnA](https://www.youtube.com/channel/UCCLXo7UDZvByw2ixzpOCufnA)].
- [29] Sams, et al. (2011-), *TED-Ed*, [[.../UCsooa4yRKGn_zEE8iknghZA](https://www.youtube.com/channel/UCsooa4yRKGn_zEE8iknghZA)].
- [30] Quintus Media GmbH (2013-), *Free Documentary*, [[.../UCijcd0GR0fkxCAZwkiuWqtO](https://www.youtube.com/channel/UCijcd0GR0fkxCAZwkiuWqtO)].
- [31] Fridman, Lex (2006-), *Lex Fridman*, [[.../UCSHZKyawb77ixDdsGog4iWA](https://www.youtube.com/channel/UCSHZKyawb77ixDdsGog4iWA)].
- [32] Nacaskul, Poomjai (2013-),
Academic Playlists, [[.../UCoX6ghLzFf7eTNNCvzlrPPA/playlists](https://www.youtube.com/channel/UCoX6ghLzFf7eTNNCvzlrPPA/playlists)],
Pasathai Chaihaikoom, [[.../UCufDmLucjmvh5azATmXkr2g](https://www.youtube.com/channel/UCufDmLucjmvh5azATmXkr2g)];
Links to
"Science - Technology, Engineering, Machines, Architectures & Innovations",
[www.youtube.com/playlist?list=PLpqw6V1AlaaTbikm6SBar0IWtngKMV5Ag],
" Science - Biology & Medicine",
[www.youtube.com/playlist?list=PLpqw6V1AlaaOPuA4mHPVm7g2Hy74v3o6C],
"Science - Quantum Physics & Quantum Computing",
[www.youtube.com/playlist?list=PLpqw6V1AlaaTbYwLFS2tg5c9fliv7RKmb].

16. Teacher Evaluation

16.1 Evaluation through CUCAS system

| Lecturer | Phone number | e-mail |
|-------------------------|--------------|--|
| Poomjai Nacaskul, Ph.D. | 090-980-2170 | Poomjai.N@chula.ac.th |