UNIVERSITY of NICOSIA

Course Syllabus

Course Code	Course Title	ECTS Credits
META-513DL	Open Web Architecture and Digital Assets	10
Prerequisites	**Department**	**Semester**
None	Digital Innovation	Fall/Spring
Type of Course	**Field**	**Language of Instruction**
Required	Metaverse	English
Level of Course	**Lecturer**	**Year of Study**
2nd Cycle	Dr. Soulla Louca	1st
Mode of Delivery	**Work Placement**	**Corequisites**
Distance Learning	N/A	N/A

Course Objectives:

The main objectives of the course are to:
1. Explain open web and decentralized web and their relation to blockchain and the Metaverse
2. Explain the decentralized web stack, including decentralized storage, content addressing, dApps, identity, payments and governance.
3. Equip students with the knowledge to understand blockchain technology and its basic components used in Metaverse such as smart contracts, and digital assets.

Learning Outcomes:

After completion of the course students are expected to be able to:
1. Critically examine and evaluate the differences between centralized, decentralized and distributed networks along with how blockchain enables trust through the study of use cases.
2. Discuss how the Internet of value can be created through the integration of the financial and information layers of the internet through examining and analyzing various decentralized markets.
3. Describe the Spatial Web and provide an understanding of convergence technologies merging to create the digital smart twin and the Spatial Web stack.
4. Explain the disruptive potential for innovation of open web, the decentralized web and spatial web in this new technological era.

Course Content:

1. **Digital Innovation**
   - Historical overview of Blockchain and other technologies and their impact
   - Open web as a new technological paradigm
   - Open web and the Metaverse: how do blockchains fit in the picture
     o Centralized vs decentralized (and distributed) networks
     o Differences/advantages/disadvantages

2. **Open web**
   - Open web and how blockchain enables trust of data (Cryptographic user keys, immutable data)
   - Exemplar use cases
   - The Decentralized Web stack (decentralized storage- e.g. IPFS, content addressing, dApps, identity, payments, governance….)
     o Open web and architecture
     o Security, control, power, privacy
     o Decentralized Open web blockchain interoperability

3. **Blockchain technology anatomy**
   - Blockchain technological components (cryptography, hash functions, digital signatures, consensus algorithms)
   - How blockchain technology works
   - Blockchain types
   - Use cases of blockchain-based systems

4. **The Decentralized network economy: Bitcoin**
   - Brief history of money
   - Network economy
   - Bitcoin transactions
   - Mining

5. **Ethereum**
   - Ethereum and its EVM.
   - Smart contracts and how they work
   - An EVM based economy
   - Other EVM-based blockchains

6. **Other Layer 1 and Layer 2 Blockchains**
   - Layer 1 and Layer 2 Blockchains
   - Use cases of various private, permissioned, consortium, and / or hybrid blockchain projects

7. **Tokenization**
   - What is tokenization and how it works
   - Classification of tokens according to the economic problem they solve
   - The Howey test
   - Challenges and benefits of tokenization

- Regulatory perspectives of tokens

8. **Blockchain use cases**
   - Contribution of Blockchain and decentralized Web to open challenges
   - Use cases

9. **The spatial web and Open web**
   - The Spatial Web and technology convergence
   - The path to Spatial Web
   - The digital smart twin and the unification concept through the convergence of technologies and ecosystems
   - The Internet of Value

10. **The Spatial Web Stack**
    - The Spatial Web Stack
    - The integration of the financial and information layers of the Web
    - Use cases of decentralized markets (where the integration of the financial an information layer is necessary)

11. **Technological Requirements**
    - Overview of main enabling technologies leading to Metaverse (IoT, Big Data, cyber-physical systems, cloud, AI, robotics, 5G and 6G
    - The Metaverse ecosystem through the eyes of the enabling technologies
    - User-centric factors

12. **Open Challenges**
    - Requirements of migrating the physical and virtual worlds in terms of the research agenda
    - Challenges, opportunities and threats of this upcoming digital transformation
    - The disruption and the innovation potential of this digital transformation
    - Use cases demonstrating the required synergies

Learning Activities and Teaching Methods:

- Faculty Lectures
- Guest-Lectures Seminars
- Directed and Background Reading
- Case Study Analysis
- Simulations
- Student-led Presentations
- In-Class Exercises

Assessment Methods [20]:

- Interactive activities and classroom participation
- Assignments
- Final exams

Assessment Methods in alignment with Intended Learning Outcomes:

Assessment Method	Weighting	Intended Learning Outcomes to be assessed			
		LO1	LO2	LO3	LO4
Interactive activities	30%	✓	✓	✓	✓
Assignments	10%	✓	✓	✓	✓
Exams	60%	✓	✓	✓	✓

Student Study Effort Expected:

Student Study Effort Expected	Hours
Lectures	12h
Assignments	30h
Interactive activities and forum participation	65h
Reading and research	140h
Exam	3h
Total	250h

Required Textbooks / Readings:

Title	Author(s)	Publisher	Year	ISBN
The Spatial Web, How Open web will Connect Humans, Machines, and AI to Transform the World	Gabriel Rene and Dan Mapes	Gabriel René and Dan Mape	2019	ISBN-10: 0578562960, ISBN-13: 978-0578562964

Recommended Textbooks / Readings:

- Alabdulwahhab, F. A. (2018). Web 3.0: The Decentralized Web Blockchain networks and Protocol Innovation. In 2018 1st International Conference on Computer Applications & Information Security (ICCAIS) (pp. 1-4). doi: 10.1109/CAIS.2018.8441990.
- Antonopoulos, A. M. (2017). Mastering Bitcoin: Programming the Open Blockchain. 2nd Edition. Sebastopol: O'Reilly Media.
- Antonopoulos, A. M., & Wood, G. (2018). Mastering Ethereum: building smart contracts and dapps. O'Reilly Media. ISBN 978-1-119-70291-7.
- Baird, K., Jeong, S., Kim, Y., Burgstaller, B., & Scholz, B. (2019). The economics of smart contracts. arXiv preprint arXiv:1910.11143.
- Bashir, I. (2017). Mastering Blockchain -Distributed ledgers, decentralization and smart contracts explained. Packt.
- Baxter Hines. (2021). Digital Finance: Security Tokens and Unlocking the Real Potential of Blockchain. Wiley. ISBN 9781119756309 (Hardcover), ISBN 9781119756323 (ePDF), ISBN 9781119756316 (ePub).
- Halaburda, H., Sarvary, M., & Haeringer, G. (2022). Beyond Bitcoin: Economics of Digital Currencies and Blockchain Technologies, 2nd Edition. Palgrave Macmillan. ISBN 978-3-030-88930-2 ISBN 978-3-030-88931-9 (eBook).

- Hollensen, S., Kotler, P., & Opresnik, M. O. (2022). Metaverse–the new marketing universe. Journal of Business Strategy.
- Kapassa, E., Themistocleous, M. 2022, "Blockchain Technology Applied in IoV Demand Response Management: A Systematic Literature Review" Future Internet 14 (5), pp. 1-19
- Kapassa, E., Themistocleous, M., Christodoulou, K., Iosif E., 2021, "Blockchain Application in Internet of Vehicles: Challenges, Contributions and Current Limitations", Future Internet 13 (12), 313 https://www.mdpi.com/1999-5903/13/12/313
- Karamitsos, I., Papadaki, M., Themistocleous, M, 2022, "Blockchain as a Service (BCaaS): A Value Modeling Approach in the Education Business Model", Journal of Software Engineering and Applications, volume 5, pp, 165-182
- Kim, S., & Deka, G. C. (Eds.). (2020). Advanced Applications of Blockchain Technology. Springer. DOI https://doi.org/10.1007/978-981-13-8775-3.
- Makridakis, S., & others. (2022). Exploring Blockchain Use Cases in Supply Chain Management. In Proceedings of the 55th Hawaii International Conference on System Sciences.
- Mozumder, M. A. I., Sheeraz, M. M., Athar, A., Aich, S., & Kim, H. -C. (2022). Overview: Technology Roadmap of the Future Trend of Metaverse based on IoT, Blockchain, AI Technique, and Medical Domain Metaverse Activity. In 2022 24th International Conference on Advanced Communication Technology (ICACT) (pp. 256-261). doi: 10.23919/ICACT53585.2022.9728808.
- Nakamoto, S. (2008). Bitcoin: A Peer-to-Peer Electronic Cash System. https://bitcoin.org/bitcoin.pdf.
- O'Dair, M. (2019). Distributed Creativity - How Blockchain Technology will Transform the Creative Economy. Palgrave Macmillan. ISBN 978-3-030-00189-6 ISBN 978-3-030-00190-2 (eBook).
- Park, S. M., & Kim, Y. G. (2022). A Metaverse: taxonomy, components, applications, and open challenges. IEEE Access.
- Touloupou, M., Christodoulou, K., Inglezakis, A., Iosif, E., and Themistocleous, M., 2022, "Benchmarking Blockchains: The case of XRP Ledger and Beyond", In the Proceedings of the Fifty-third Annual Hawaii International Conference on System Sciences, (HICSS 55), January 4-7, 2022. Maui, Hawaii, USA, IEEE Computer Society, Los Alamitos, California, USA. https://scholarspace.manoa.hawaii.edu/bitstream/10125/80070/0586.pdf
- Touloupou, M., Christodoulou, K., Inglezakis, A., Iosif, E., Themistocleous, M., 2021. "Towards a Framework for Understanding the Performance of Blockchains", 3rd Conference on Blockchain Research & Applications for Innovative Networks and Services (BRAINS), https://ieeexplore.ieee.org/abstract/document/9569810
- Touloupou, M., Themistocleous, M, Iosif E., Christodoulou, K., 2022, "A Systematic Literature Review Towards a Blockchain Benchmarking Framework", IEEE Access, Vol. 10, pp. 7630-7644, https://ieeexplore.ieee.org/abstract/document/9813702/authors#authors