
# Digital4Business Joint Post-Graduate Certificate in Advanced Digital Technologies for Business

Module Handbook 2025

# Table of Contents

# Preface

The Joint Professional **Master's Degree in Advanced Digital Technologies for Business** has been meticulously designed and developed by the Digital4Business consortium. Funded by the European Commission with a budget of €19.92 million, Digital4Business represents a collaborative effort involving 15 partners across seven EU countries. Our mission is to nurture the next generation of digital leaders and innovators equipped with the competencies required to navigate and shape the digital transformation of businesses throughout Europe.

As a special constituent of subject-specific learning in the context of the Master's Programme, students have the opportunity to complete individual modules as **micro-credentials** as well combinations of these micro-credentials in the form of a **post-graduate certificate (PGC)** to provide the opportunity of a more competency-oriented learning approach, providing exactly the skills required by the industry.

---

**About this Document**

This handbook contains detailed module descriptors for the five modules that are offered individually and that can be combined to form the Post-Graduate Certificate in Advanced Digital Technologies for Business.

---

Yours truly,

The DIGITAL4Business Consortium

Wednesday 30 April 2025

# Modules

## Digital Transformation

<table>
<tr><td>Module designation</td><td>Digital Transformation</td></tr>
<tr><td>Semester(s) in which the module is taught</td><td><table><tr><td>Full Time</td><td>Semester 1 (Year 1)</td></tr><tr><td>Part Time</td><td>Semester 1 (Year 1)</td></tr></table></td></tr>
<tr><td>Partner responsible for the module</td><td><u>UNIBO</u></td></tr>
<tr><td>Person responsible for the module</td><td>Chiara Panciroli (scientific responsibility)<br>Marika Mascitti (organizational responsibility)</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Compulsory</td></tr>
<tr><td>Teaching methods</td><td>Teaching is fully online. The module employs an innovative hybrid learning methodology, alternating between synchronous and asynchronous activities. A tutor, both an expert in module content and a facilitator of student learning, supports students throughout. Key methods include:<ul><li>Synchronous Lectures: Interactive, real-time sessions.</li><li>Asynchronous Activities: Independent study and project-based tasks archived in a digital e-portfolio.</li><li>Group Work: Laboratory exercises to foster collaborative problem-solving.<br>The main teaching strategies include Work-Based Learning, Problem-Based Learning, Gamification, and Flipped Classroom techniques. Emerging technologies, including Artificial Intelligence, are integrated to enhance learning experiences.</li></ul></td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td><table><tr><td>Classroom & Demonstrations (hours)</td><td>36</td></tr><tr><td>Other hours (Practical work /work-based learning)</td><td>24</td></tr><tr><td>Independent learning (hours)</td><td>190</td></tr><tr><td>Total (hours)</td><td>250</td></tr></table></td></tr>
<tr><td>Credit points</td><td>10 ECTS</td></tr>
</table>

| | |
|---|---|
| **Recommended prerequisites for joining the module** | 1. Basic understanding of digital technologies and organisational processes.<br>2. Familiarity with business operations and change management.<br>3. Introductory knowledge of data-driven decision-making. |
| **Module objectives/intended learning outcomes** | The module aims to enable students to understand, discuss and synthesise the fundamentals of Digital Transformation and the main Digital Implementation strategies.<br>The Digital Transformation Module is a deep dive into the essentials of digital transformation concepts and enablers. Students will critically assess digital transformation paradigms to understand their influence on innovative business models, while defining the deployment of strategic resources for effective digital change. The course emphasises the design and implementation of cutting-edge digital transformation strategies, using practical exercises to simulate real-world applications. This module aims to equip students with the necessary skills to navigate and lead digital transformation efforts, preparing them to effectively manage and capitalise on the opportunities of the digital business landscape.<br>This curricular unit intends to develop methodological and research skills on business and digital transformation.<br><br>Upon successful completion of this module, learners will be able to:<br>**LO1:** Analyse and Synthesise the Key Concepts and Enablers of Digital Transformation.<br>**LO2:** Critically Evaluate Digital Transformation Paradigms and their Impact on Innovative Business Models.<br>**LO3:** Assess and Strategize the Deployment of Strategic Resources for Digital Transformation,<br>**LO4:** Design and Implement Advanced Strategies for Digital Business Transformation. |

<table>
<tr><td>Content</td><td>Digital Transformation is a 10 ECTS module delivered over 3 hours per week for 12 weeks. Below is an indicative programme of the topics to be covered each week:<br><br>
<table>
<tr><th></th><th>Lecture Topic</th><th>Lecture Detail</th></tr>
<tr><td>1</td><td>Introduction to Digital Transformation</td><td>Basic concepts of digital transformation. Evolution stages of digital transformation. Economic and social impacts. Digital paradigms and platform economy. Ethical issues in digital transformation. Interdisciplinary connections.</td></tr>
<tr><td>2</td><td>Technologies and Innovations</td><td>Emerging digital technologies (AI, Blockchain, IoT). Strengths and weaknesses of main digital technologies. Evolution of AI.</td></tr>
<tr><td>3</td><td>Big Data and Platform society</td><td>Platform-based business strategies. Platform economy case studies. Digital and data literacy.</td></tr>
<tr><td>4</td><td>Digital Competences</td><td>Digital competences framework. Digital communication skills and capabilities. Upskilling and reskilling.</td></tr>
<tr><td>5</td><td>Sustainable Development Goals (SDGs) framework and Digital Transformation</td><td>Ethics and sustainability in the digital age. UN SDGs. Digital projects supporting SDGs. Circular economy. KPIs for digital sustainability. CSR and social impact.</td></tr>
<tr><td>6</td><td>Digital Transformation Design: Methodologies and Tools</td><td>Industry trends in digital transformation. Tools and methodologies for organizational culture and innovation. SWOT analysis.</td></tr>
</table>
Sessions 7-12: To be detailed according to specific institutional and module requirements, potentially covering advanced topics in AI, detailed case studies in digital transformation across industries, deep dives into ethical considerations, and hands-on workshops with digital tools and methodologies.</td></tr>
</table>

<table>
<tr><td>Exams and assessment formats</td><td>Both formative (ongoing) and summative (final) assessments will be implemented in the module to measure student progress. Formative assessments can provide feedback to help students improve their overall study pathway. Clear assessment rubrics and criteria will be created for each topic, indicating how students will be assessed against learning objectives. The different assessment tools (e.g. examinations, assignments, projects, exercises) will allow direct measurement of the students' knowledge, skills, and competences.<br><br>
<table>
<tr><th>Assessment Type</th><th>Assessment Description</th><th>Outcome addressed</th><th>% of total</th><th>Assessment Date</th></tr>
<tr><td>Continuous assessment (Assessment rubrics)</td><td>Clear rubrics and grading criteria are created for each topic, indicating how students will be evaluated against the ILOs. Formative assessments can provide feedback to help students improve.</td><td>LO1, LO2, L03</td><td>60%</td><td>Ongoing</td></tr>
<tr><td>Proctored Written Test</td><td>Summative (final learning) assessment to measure students' progress at the end of the module.</td><td>L03, L04</td><td>40%</td><td>Week 8</td></tr>
</table>
</td></tr>
<tr><td>Study and examination requirements</td><td>Students must have an overall final grade of 40% or higher to pass this module.</td></tr>
</table>

| | |
|---|---|
| **Reading list** | Recommended Resources<br>• Bughin J, Catlin T, Hirt M, Willmott P. Digital transformation: Improving the odds of success. McKinsey Quarterly. 2020.<br>• ISO/IEC 38500:2015. Governance of information technology for the organization. International Organization for Standardization. URL: http://www.iso.org/iso/catalogue_detail?csnumber=62816.<br>• Kane GC, et al. The technology fallacy: How people are the real key to digital transformation. MIT Press; 2019.<br>• Schmarzo B. The Economics of Data, Analytics, and Digital Transformation: The theorems, laws, and empowerments to guide your organization's digital transformation. Packt Publishing; 2020.<br>• Siebel TM. Digital Transformation: Survive and Thrive in an Era of Mass Extinction. Rodin Books; 2019.<br>• Westerman G, Bonnet D, McAfee A. Leading Digital: Turning Technology into Business Transformation. Harvard Business Review Press; 2014.<br><br>Supplementary Resources<br>• Christensen, CM. The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail. Boston, MA: HBS Press, 1997.<br>• Corazza GE, Darbellay F, Lubart T, Panciroli C. Developing Intelligence and Creativity in Education: Insights from the Space-Time Continuum. In: Creativity and Learning. London: Palgrave Macmillan; 2021.<br>• Corazza L, Macauda A, Panciroli C, Parola A, Rivoltella PC. Audiovisual as an Atelier. Theoretical Framework and Educational Applications. In Higher Education Learning Methodologies and Technologies Online. Cham: Springer; 2023. p. 59–70.<br>• Marr B. Artificial Intelligence in Practice: How 50 Successful Companies Used AI and Machine Learning to Solve Problems. Wiley; 2019.<br>• Panciroli C et al. Augmented Reality in Arts Education. In: Springer Handbook of Augmented Reality. Cham: Springer; 2023. p. 305–333.<br>• Panciroli C, Fabbri M, Macauda A. Educational Robotics between Neurosciences and Artificial Intelligence: a systematic analysis. Giorn Ital Edu Salute Sport Didatt Inclus. 2021; 5:330–339.<br>• Schwab K. The Fourth Industrial Revolution. World Economic Forum; 2016.<br>• Tapscott D, Tapscott A. Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World. Portfolio; 2016. |

## AI for Business

<table>
<tr><td>Module designation</td><td colspan="2">AI for Business</td></tr>
<tr><td>Semester(s) in which the module is taught</td><td>Full Time</td><td>Semester 1, Semester 2 (Year 1)</td></tr>
<tr><td></td><td>Part Time</td><td>Semester 1, Semester 2 (Year 1)<br>Semester 1, Semester 2 (Year 2)</td></tr>
<tr><td>Partner responsible for the module</td><td colspan="2"><u>LIU</u></td></tr>
<tr><td>Person responsible for the module</td><td colspan="2">Fredrik Heintz<br>Ibrahim Delibasoglu</td></tr>
<tr><td>Language</td><td colspan="2">English</td></tr>
<tr><td>Relation to curriculum</td><td colspan="2">Elective</td></tr>
<tr><td>Teaching methods</td><td colspan="2">Teaching is fully online, blending synchronous and asynchronous activities to engage students in the theoretical and practical aspects of AI in business. The module uses innovative methods tailored to business problem-solving and enhancing digital competence.<br><br>Teaching activities include:<br><br>• Interactive Lectures: Core AI concepts are introduced through synchronous sessions featuring business scenarios and case studies to foster critical thinking and practical understanding.<br>• Weekly Quizzes: Formative assessments reinforce key topics, provide feedback, and measure comprehension.<br>• Laboratory Activities: Applied sessions with Jupyter notebooks enable hands-on coding to solve business-focused problems, enhancing technical proficiency.<br>• Collaborative Projects: Team-based AI solution design for business challenges promotes collaboration, teamwork, and service orientation.<br>• Problem-Based Learning and Flipped Classroom: Pre-class resources support independent study, allowing live sessions to focus on discussions, problem-solving, and practical applications.</td></tr>
</table>

<table>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td><table>
<tr><td>Classroom & Demonstrations (hours)</td><td>24</td></tr>
<tr><td>Other hours (Practical work /work-based learning)</td><td>36</td></tr>
<tr><td>Independent learning (hours)</td><td>190</td></tr>
<tr><td>Total (hours)</td><td>250</td></tr>
</table></td></tr>
<tr><td>Credit points</td><td>10 ECTS</td></tr>
<tr><td>Recommended prerequisites for joining the module</td><td>1. Basic knowledge of linear algebra, probability theory, and programming (preferably Python).<br>2. Knowledge in logic and discrete mathematics is useful.</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td>The primary objective of this module is to provide a comprehensive understanding of the fundamental theories, methods, and models that underlie machine learning (ML) and artificial intelligence (AI). The module delves into AI and ML, focusing on their analysis, synthesis, and innovation within business contexts. Students will learn to design, train, and evaluate advanced ML models using innovative data and optimisation strategies to address real-world business challenges. Key components include rigorous performance assessment techniques, result interpretation, and effective communication of implications.<br><br>This module will equip students with the skills to innovate and improve business processes through advanced machine learning models, leading to enhanced decision-making, increased efficiency, and competitive advantage in the market. Students will also develop transferable and soft skills such as problem-solving, communication, collaboration, teamwork, and service orientation. They will apply strategic thinking to complex AI applications, critically assessing and enhancing their effectiveness in business settings.<br><br>The module addresses AI's ethical, societal, and environmental impacts, guiding students to propose responsible development and implementation practices. It prepares students to navigate the complexities of technology responsibly, ensuring that AI implementations are socially acceptable and environmentally sustainable, thus safeguarding organisational reputation and contributing to long-term success.</td></tr>
</table>

<table>
<tr><td></td><td>Upon successful completion of this module, learners will be able to:<br><br>LO1: Analyse, synthesise, and innovate within artificial intelligence and machine learning, emphasising critical understanding and the capability to advance the field.<br>LO2: Design, train, and critically evaluate advanced machine learning models, focusing on innovative data and optimisation strategies to boost performance in business applications.<br>LO3: Employ innovative techniques for rigorous machine learning model performance assessment, interpret results, and effectively communicate implications across various business contexts and to diverse stakeholders.<br>LO4: Apply strategic thinking in AI and ML for complex applications, assess effectiveness critically, propose innovative solutions or improvements, and improve problem-solving and decision-making skills.<br>LO5: Teamwork to develop AI solutions, enhancing collaboration skills, team competences, and service orientation towards addressing business needs.<br>LO6: Critically explore AI and machine learning's ethical, societal, and environmental impacts, and propose ethical, sustainable development and implementation practices within business environments.</td></tr>
<tr><td>Content</td><td>AI for Business is a 10 ECTS module delivered over 5 hours per week for 12 weeks. An indicative schedule of topics to be addressed each week is outlined below:<br><br>
<table>
<tr><th></th><th>Lecture Topic</th><th>Lecture Detail</th></tr>
<tr><td>1</td><td>Introduction to AI and its history.</td><td>Overview of AI, significance in today's world, historical development, key milestones, and introduction to AI-driven business solutions.</td></tr>
<tr><td>2</td><td>Foundational Knowledge for AI</td><td>Problem-solving, search algorithms, heuristics, adversarial search, and optimization techniques applied to business challenges. Development of analytical and problem-solving skills</td></tr>
<tr><td>3</td><td>Automated Planning</td><td>Goal achievement, decision-making, resource allocation, simulation, prediction, learning, adaptation, autonomous systems. Application of automated planning to improve business workflows and operational efficiency. Collaboration on planning projects.</td></tr>
<tr><td>4</td><td>Introduction to Machine Learning</td><td>Overview of ML, supervised/unsupervised learning, reinforcement learning, introduction to deep learning. Applying ML techniques to analyse business data. Enhancing data-driven decision-making skills.</td></tr>
</table>
</td></tr>
</table>

| | | | |
|---|---|---|---|
| | 5 | Deep Learning | Neural networks, CNNs, RNNs, deep learning applications, fostering innovation and creative thinking in developing business solutions. |
| | 6 | Data and Datasets | Importance of data, data types, data quality, pre-processing, quality datasets for business intelligence. Emphasis on teamwork in handling data projects and ensuring data integrity for AI applications. |
| | 7 | Reinforcement Learning | Basics of reinforcement learning, exploration vs. exploitation, real-world applications in business. Developing strategic thinking and problem-solving skills. |
| | 8 | Natural Language Processing (NLP) | NLP fundamentals, text processing, NLP models and techniques. Applications in sentiment analysis and customer service. Enhancing communication skills by interpreting and presenting NLP insights. |
| | 9 | Computer Vision | Basics of computer vision, image processing, object detection, challenges, and future trends. Applications in business industry and security. Collaborative projects to implement computer vision solutions. |
| | 10 | AI Tools and Platforms | Overview of AI tools/platforms, practical applications, deep learning frameworks. Selecting and integrating appropriate tools for business needs. Enhancing technical proficiency and decision-making skills. |
| | 11 | AI and creativity | AI in creative industries, design, innovation, product development, marketing strategies and prospects, industry speaker session. |
| | 12 | Ethical and Social implications in AI | Ethical challenges, societal impacts, AI bias and fairness, privacy, security. Developing ethical reasoning and responsibility in AI implementations within business environments. |
| **Exams and assessment formats** | Both formative (ongoing) and summative (final) assessments will be implemented in the module to measure student progress. Formative assessments can provide feedback to help students improve their overall study pathway.<br>Clear assessment rubrics and criteria will be created for each topic, indicating how students will be assessed against learning objectives. The different assessment methods (e.g. laboratory assignments, projects, | | |

<table>
<tr><td></td><td>exercises) will allow direct measurement of the students' knowledge, skills, and competences.<br><br>
<table>
<tr><th>Assessment Type</th><th>Assessment Description</th><th>Outcome addressed</th><th>% of total</th><th>Assessment Date</th></tr>
<tr><td>Project</td><td>Project focusing on applying AI tools / techniques to address a business focused problem.</td><td>LO3, LO4</td><td>50%</td><td>Week 12</td></tr>
<tr><td>Proctored Written Test</td><td>Summative (final learning) assessment to measure students' progress at the end of the module.</td><td>LO1, LO2, LO5</td><td>50%</td><td>Terminal Exam</td></tr>
</table></td></tr>
<tr><td>Study and examination requirements</td><td>Students must have an overall final grade of 40% or higher to pass this module.</td></tr>
</table>

| | |
|---|---|
| **Reading list** | Recommended Resources<br>• Du Sautoy M. The Creativity Code: Art and Innovation in the Age of AI. Harvard University Press; 2019.<br>• Ghallab M, Nau D, Traverso P. Automated Planning: Theory & Practice. Elsevier; 2004.<br>• Goodfellow I, Bengio Y, Courville A. Deep Learning. MIT Press; 2016.<br>• Jurafsky D, Martin JH. Speech and Language Processing. 3rd ed. Prentice Hall; 2021.<br>• Murphy KP. Machine Learning: A Probabilistic Perspective. MIT Press; 2012.<br>• Russell SJ, Norvig P. Artificial intelligence: a modern approach. 4th ed. Pearson; 2020.<br>• Sutton RS, Barto AG. Reinforcement Learning: An Introduction. 2nd ed. MIT Press; 2018.<br>• IEEE Standards Association. Ethically Aligned Design: A Vision for Prioritizing Human Well-being with Autonomous and Intelligent Systems. https://standards.ieee.org/content/ieee-standards/en/industry-connections/ec/autonomous-systems.html.<br><br>Supplementary Resources<br>• Anthes G. Artificial intelligence poised to ride a new wave. Communications of the ACM. 2017 Jul;60(7):19–21.<br>• Gomez-Uribe CA, Hunt N. The Netflix Recommender System: Algorithms, Business Value, and Innovation. ACM Trans Manage Inf Syst. 2016 Jan;6(4): Article 13, 19 pages.<br>• Monett D, Lewis CWP, Thórisson KR, et al. Special Issue "On Defining Artificial Intelligence" - Commentaries and Author's Response. Journal of Artificial General Intelligence. 2020 Feb;11(2).<br>• O'Neil C. Weapons of Math Destruction: How Big Data Increases Inequality and Threatens Democracy. Crown; 2016.<br>• Poole D, Mackworth A. Artificial Intelligence: Foundations of Computational Agents. 2nd ed. Cambridge University Press; 2017.<br>• Stanley KO. Why Open-Endedness Matters. Artificial Life. 2019 Summer;25(3):232-235.<br>• Szeliski R. Computer Vision: Algorithms and Applications. Springer; 2011.<br>• Vaswani A, Shazeer N, Parmar N, et al. Attention is all you need. In: NIPS'17. Red Hook, NY, USA: Curran Associates Inc.; 2017. p. 6000–6010. |

## Data Science for Business

<table>
<tr><td>Module designation</td><td colspan="2">Data Science for Business</td></tr>
<tr><td>Semester(s) in which the module is taught</td><td>Full Time</td><td>Semester 1, Semester 2 (Year 1)</td></tr>
<tr><td></td><td>Part Time</td><td>Semester 1, Semester 2 (Year 1)<br>Semester 1, Semester 2 (Year 2)</td></tr>
<tr><td>Partner responsible for the module</td><td colspan="2"><u>UNL</u></td></tr>
<tr><td>Person responsible for the module</td><td colspan="2">Roberto Henriques</td></tr>
<tr><td>Language</td><td colspan="2">English</td></tr>
<tr><td>Relation to curriculum</td><td colspan="2">Elective</td></tr>
<tr><td>Teaching methods</td><td colspan="2">The module employs innovative teaching methodologies with a focus on solving real-world business problems, fostering both technical and transferable skills:<br>Teaching activities include:<br>• Hybrid Learning: A mix of synchronous (live online lectures and discussions) and asynchronous (self-paced materials, recorded lectures, and activities) formats.<br>• Problem-Based Learning (PBL): Students work on practical case studies and business scenarios to develop problem-solving and critical thinking skills.<br>• Flipped Classroom: Students review core materials independently before engaging in interactive activities.<br>• Collaborative Learning: Includes group-based exercises and peer reviews to promote teamwork and collaboration.</td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td>Classroom & Demonstrations (hours)</td><td>36</td></tr>
<tr><td></td><td>Other hours (Practical work /Tutorial)</td><td>36</td></tr>
<tr><td></td><td>Independent learning (hours)</td><td>178</td></tr>
<tr><td></td><td>Total (hours)</td><td>250</td></tr>
<tr><td>Credit points</td><td colspan="2">10 ECTS</td></tr>
<tr><td>Recommended prerequisites for joining the module</td><td colspan="2">1. Basic understanding of mathematics and statistics.<br>2. Familiarity with spreadsheets (e.g., Excel).<br>3. Introductory exposure to programming concepts (optional).</td></tr>
</table>

| | |
|---|---|
| **Module objectives/intended learning outcomes** | This module equips students with the ability to use data science methodologies to address complex business challenges while fostering essential transferable skills such as communication, collaboration, and problem-solving.<br><br>Upon successful completion of this module, learner will be able to:<br><br>**LO1:** Evaluate and integrate data science principles to solve real-world business challenges, demonstrating creativity in data interpretation and insight extraction. (Transferable Skill: Critical Thinking)<br>**LO2:** Apply advanced data science methods and algorithms to develop and optimize models that address complex business problems. (Transferable Skill: Problem Solving)<br>**LO3:** Synthesize insights using statistical and machine learning techniques to make informed decisions, effectively communicating results to diverse audiences. (Transferable Skill: Communication)<br>**LO4:** Design and assess advanced visualizations, dashboards, and BI tools to deliver actionable insights and enhance business decision-making. (Transferable Skill: Service Orientation)<br>**LO5:** Collaborate within teams to design and implement data-driven solutions, fostering teamwork and adaptability. (Transferable Skill: Team Competence) |

| | |
|---|---|
| **Content** | Data Science for Business is a 10 ECTS module delivered over 5 hours per week for 12 weeks. An indicative schedule of topics to be addressed each week is outlined below: |

| | Lecture Topic | Lecture Detail |
|---|---|---|
| 1 | Introduction to Data Science | Overview of the data science lifecycle, focusing on how data science methodologies (e.g., CRISP-DM) help solve business challenges. Discussion of real-world case studies where data-driven decision-making led to tangible outcomes. |
| 2 | Python for Data Science | Python programming basics, data structures, packages for data analysis. |
| 3 | Data Collection and APIs | APIs, web scraping, working with unstructured data sources. |
| 4 | Databases and Data Warehousing | Introduction to relational databases and SQL. Covers ETL processes and data warehousing principles to organize and structure business-critical data for analytics. |
| 5 | Data Pre-processing and Cleaning | Handling missing data, outliers, feature encoding, normalization. |
| 6 | Exploratory Data Analysis | Use of summary statistics and visualizations to discover patterns and relationships in business data. Real-world applications in identifying customer segments and performance trends. |
| 7 | Statistical Analysis and Modelling | Statistical techniques such as regression, classification, and forecasting, tailored to solving business problems like demand forecasting and customer behaviour analysis. |
| 8 | Machine Learning | Supervised learning models (e.g., linear regression, decision trees) and their role in addressing business challenges like churn prediction and risk assessment. |
| 9 | Advanced Machine Learning Methods | Explore advanced techniques such as neural networks and deep learning. Applications in optimizing operations, personalizing customer experiences. |
| 10 | Business Intelligence and Analytics | The BI process, including data preparation, dashboard development, and predictive analytics. Real-world applications in performance monitoring and strategic decision-making. |
| 11 | Data Visualization and Dashboards | Principles of visual encodings and interactive dashboards for effective communication of data-driven insights. Applications in KPI tracking and stakeholder engagement. |
| 12 | Ethics, Bias and Privacy in Data Science and major trends in ML and DS | Address ethical considerations, bias mitigation, and privacy concerns in the application of data science in business contexts. Discussion of emerging trends like generative AI and explainable AI in solving business challenges. |

| | |
|---|---|
| **Exams and assessment formats** | The assessments are carefully designed to align with the learning outcomes and foster the development of both technical and transferable skills.<br>Assessment Types:<br>• Project (50%): Real-world application of data science tools/techniques to address a business-focused problem.<br>  ○ LOs Addressed: LO2, LO3, LO4, LO5<br>  ○ Skills Measured: Problem-solving, collaboration, and communication.<br>• Proctored Written Test (50%): Summative assessment to evaluate knowledge, understanding, and application of data science in business contexts.<br>  ○ LOs Addressed: LO1, LO2, LO4<br>  ○ Skills Measured: Critical thinking, analytical reasoning, and ethical awareness. |
| **Study and examination requirements** | Students must have an overall final grade of 40% or higher to pass this module. |
| **Reading list** | Recommended Resources<br>• Efron B, Hastie T. Computer Age Statistical Inference: Algorithms, Evidence, and Data Science. Cambridge: Cambridge Univ. Press; 2016.<br>• Géron A. Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems. O'Reilly Media; 2019.<br>• Hand DJ, Mannila H, Smyth P. Principles of Data Mining (Adaptive Computation and Machine Learning). MIT Press; 2001.<br>• Hastie T, Tibshirani R, Friedman J. The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second Edition. New York: Springer; 2009.<br>• Leskovec J, Rajaraman A, Ullman JD. Mining of Massive Datasets, 3rd Edition. Cambridge: Cambridge University Press; 2020.<br>• Wasserman L. All of Statistics: A Concise Course in Statistical Inference. New York: Springer; 2004.<br>Supplementary Resources<br>• Abbott D. Applied Predictive Analytics: Principles and Techniques for the Professional Data Analyst. Wiley; 2014.<br>• Alloghani M, Al-Jumeily D, Mustafina J, et al. A Systematic Review on Supervised and Unsupervised Machine Learning Algorithms for Data Science. Springer, Cham; 2020.<br>• Georgieva I, Lazo C, Timan T et al. From AI ethics principles to data science practice: a reflection and a gap analysis based on recent frameworks and practical experience. AI Ethics. 2022; 2:697–711. |

| | |
|---|---|
| | • James G, Witten D, Hastie T, Tibshirani R. An Introduction to Statistical Learning: with Applications in R. New York: Springer; 2013.<br>• Niu Y, Ying L, Yang J, Bao M, Sivaparthipan CB. Organizational business intelligence and decision making using big data analytics. Information Processing & Management. 2021;58(6):102725.<br>• Provost F, Fawcett T. Data Science and its Relationship to Big Data and Data-Driven Decision Making. Big Data. 2013;1(1):51-59.<br>• Sarker IH, Kayes ASM, Badsha S et al. Cybersecurity data science: an overview from machine learning perspective. J Big Data. 2020; 7:41.<br>• Waller MA, Fawcett SE. Data Science, Predictive Analytics, and Big Data: A Revolution That Will Transform Supply Chain Design and Management. J Bus Logist. 2013;34(2):77-84.<br>• Wilkerson MH, Polman JL. Situating Data Science: Exploring How Relationships to Data Shape Learning. J Learn Sci. 2020;29(1):1–10.<br>• Yu B. Veridical Data Science. In Proceedings of the 13th International Conference on Web Search and Data Mining (WSDM '20). ACM, New York, NY, USA; 2020. p. 4–5. |

## Cybersecurity for Business

<table>
<tr><td>Module designation</td><td colspan="2">Cybersecurity for Business</td></tr>
<tr><td>Semester(s) in which the module is taught</td><td>Full Time</td><td>Semester 1, Semester 2 (Year 1)</td></tr>
<tr><td></td><td>Part Time</td><td>Semester 1, Semester 2 (Year 1)<br>Semester 1, Semester 2 (Year 2)</td></tr>
<tr><td>Partner responsible for the module</td><td colspan="2"><u>LIU</u></td></tr>
<tr><td>Person responsible for the module</td><td colspan="2">Mikael Asplund</td></tr>
<tr><td>Language</td><td colspan="2">English</td></tr>
<tr><td>Relation to curriculum</td><td colspan="2">Elective</td></tr>
<tr><td>Teaching methods</td><td colspan="2">Teaching is fully online, blending synchronous and asynchronous activities, engaging students in both theoretical and practical aspects of cybersecurity. The module leverages innovative teaching methodologies tailored to solving cybersecurity issues in business and enhancing digital competence.<br><br>Teaching activities include:<br><br>• Interactive Lectures: Core cybersecurity concepts are introduced through synchronous sessions featuring real-world scenarios and business case studies to foster critical thinking and practical understanding.<br>• Weekly Quizzes: Formative assessments reinforce key topics, provide feedback, and measure comprehension.<br>• Laboratory Activities: Interactive sessions enable hands-on experience in identifying vulnerabilities and simulating security breaches, enhancing technical proficiency in cybersecurity problem-solving.<br>• Collaborative Project: Team-based cybersecurity risk management promotes collaboration, teamwork, and service orientation towards protecting organisational data.</td></tr>
</table>

<table>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td><table>
<tr><td>Classroom & Demonstrations (hours)</td><td>36</td></tr>
<tr><td>Other hours (Practical work /Tutorial)</td><td>24</td></tr>
<tr><td>Independent learning (hours)</td><td>190</td></tr>
<tr><td>Total (hours)</td><td>250</td></tr>
</table></td></tr>
<tr><td>Credit points</td><td>10 ECTS</td></tr>
<tr><td>Recommended prerequisites for joining the module</td><td>1. Familiarity with basic programming skills,<br>2. Basic understanding of computer systems, business processes, and risk management</td></tr>
<tr><td>Module objectives/intended learning outcomes</td><td>The module aims to enable learners to explore the field of cybersecurity. It focuses on identifying and mitigating security breaches in personal and organisational data systems.<br><br>Students will learn to identify and assess vulnerabilities in data systems, understanding how these can lead to security breaches in business environments. The course will equip students with the skills to create strong protection strategies, ensuring that data remains safe from potential threats. In addition, the module will delve into the legal and ethical dimensions of cybersecurity. Students will also develop transferable and soft skills such as problem-solving, communication, collaboration, teamwork, and service orientation. They will apply strategic thinking to complex cybersecurity applications, critically assessing and enhancing their effectiveness in business settings.<br><br>Upon successful completion of this module, learners will be able to:<br><br>LO1: Analyse and critically evaluate vulnerabilities in personal and organisational data systems to identify potential security breaches and suggest mitigative strategies, fostering analytical thinking and attention to detail.<br>LO2: Synthesise and apply advanced concepts and techniques of cyber-attacks to simulate potential security breaches, demonstrating a comprehensive understanding of cyber threat landscapes and training problem-solving abilities and decision-making skills.<br>LO3: Design and implement robust strategies for the protection of personal and organisational data, utilising encryption techniques and security protocols to mitigate potential threats.<br>LO4: Evaluate and integrate tools and methodologies for the prevention and detection of cyber-attack incidents,</td></tr>
</table>

<table>
<tr><td></td><td>developing critical thinking skills and demonstrating an ability to anticipate and counteract emerging cyber threats.<br>LO5: Critically assess and debate cybersecurity legal and ethical issues, formulating well-justified recommendations for policy and practice that reflect an advanced understanding of the complexities and responsibilities in the field of cybersecurity, developing adaptability and continuous learning habits in a rapidly evolving field.</td></tr>
<tr><td>Content</td><td>Cybersecurity for Business is a 10 ECTS module delivered over 5 hours per week for 12 weeks. An indicative schedule of topics to be addressed each week is outlined below:<br><br>
<table>
<tr><th></th><th>Lecture Topic</th><th>Lecture Detail</th></tr>
<tr><td>1</td><td>Introduction to Cybersecurity.</td><td>Overview of cybersecurity, its importance, and the growing demand for professionals. Understanding online identity, data, and their significance to cybercriminals. Seminar on real-world cybersecurity challenges.</td></tr>
<tr><td>2</td><td>Risk Management and Compliance</td><td>Exploring the significance of safeguarding electronic information networks and data.<br>Regulatory compliance requirements for business. Implementing risk assessments and developing risk mitigation strategies: Lab on security breach case studies.</td></tr>
<tr><td>3</td><td>Network security for Business</td><td>Addressing software and hardware vulnerabilities, device, network, and cloud security. Implementing secure network infrastructure including best practices for securing wireless networks and remote access.<br>Lab on securing the application landscape, incident response planning and security incidents management.</td></tr>
<tr><td>4</td><td>Cyber Attacks: Concepts and Techniques</td><td>Analysis of cyberattacks, identifying and classifying security vulnerabilities. Understanding endpoint security challenges in business environments. Securing IoT devices and other connected endpoints in business networks<br>Seminar on vulnerabilities and real-world use cases.</td></tr>
<tr><td>5</td><td>Data and Privacy Protection</td><td>Best practices for protecting computer devices, wireless networks, and online accounts. Implementing cryptographic methods for business data. Exploration of ethical implications and considerations in using AI and cryptography for data privacy</td></tr>
</table>
</td></tr>
</table>

| | | | |
|---|---|---|---|
| | | | protection. Practical exercises on implementing cryptographic techniques for privacy-preserving data sharing and analysis. Lab on data encryption and backup strategies. |
| | 6 | Organisational protection and cloud security for business | Techniques for firewall configuration, port scanning, and certificate updates. Securing cloud services and data storage in public, private, and hybrid cloud environments. Identity and access management in the cloud. Data backup and disaster recovery planning for cloud-based systems. Lab on using tools for security monitoring. |
| | 7 | Cyberattack Detection and Cyberdefense | Real-time attack detection, best security practices, and understanding botnets and the kill chain. Lab on behaviour-based security. |
| | 8 | Tools for incident prevention and detection | Overview of CSIRT, security playbooks, IDS, and IPS |
| | 9 | Cybersecurity Legal Issues | Personal legal issues. Corporate Legal Issues International Law and Cybersecurity |
| | 10 | Ethical Issues in Cybersecurity | Overview of cybersecurity laws, regulations, and industry standards applicable to businesses. Understanding ethical considerations in cybersecurity decision-making. Addressing legal and ethical challenges related to incident response, data breaches, and privacy violations. Discussion on ethical considerations and the role of professional organisations in cybersecurity ethics. |
| | 11 | Cyberwarfare | Understanding cyberwarfare, its objectives, and impacts. |
| | 12 | Emerging Topics and Careers in Cybersecurity | Exploration of AI in cyberattacks and defence, the geopolitical aspects of cyberspace, and blockchain technology |
| **Exams and assessment formats** | Both formative (ongoing) and summative (final) assessments will be implemented in the module to measure student progress. Formative assessments can provide feedback to help students improve their overall study pathway. Clear assessment rubrics and criteria will be created for each topic, indicating how students will be assessed against learning objectives. The different assessment tools (e.g. examinations, | | |

<table>
<tr><td></td><td>assignments, projects, exercises, hackathon, papers reviews) will allow direct measurement of the students' knowledge, skills and competences.<br><br>
<table>
<tr><th>Assessment Type</th><th>Assessment Description</th><th>Outcome addressed</th><th>% of total</th><th>Assessment Date</th></tr>
<tr><td>Project</td><td>Project focusing on cybersecurity risk management related to business focused problems.</td><td>LO1, LO3, LO5</td><td>30%</td><td>Week 6 and 12</td></tr>
<tr><td>Proctored Written Test</td><td>Summative (final learning) assessment to measure students' progress at the end of the module.</td><td>LO1, LO3, LO5</td><td>30%</td><td>Terminal Exam</td></tr>
<tr><td>Laboratory exercises</td><td>Laboratory exercises in cybersecurity training environment</td><td>LO2, LO4</td><td>40%</td><td>Throughout course</td></tr>
</table></td></tr>
<tr><td>Study and examination requirements</td><td>Students must have an overall final grade of 40% or higher to pass this module.</td></tr>
<tr><td>Reading list</td><td><u>Recommended Resources</u><br>
<ul>
<li>Bishop M. Computer Security: Art and Science. 2nd ed. Boston: Addison-Wesley; 2018.</li>
<li>Bodmer M, Kilger M, Carpenter G, Jones J. Reverse Deception: Organized Cyber Threat Counter-Exploitation. McGraw-Hill; 2012.</li>
<li>Casey E. Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet. 3rd ed. Academic Press; 2011.</li>
<li>Information Systems Security Association. ISSA Code of Ethics. Information Systems Security Association;2023. Available from: https://www.issa.org/issa-code-of-ethics/</li>
<li>Kim G, Spafford G, Kerner SM. The Phoenix Project: A Novel about IT, DevOps, and Helping Your Business Win. IT Revolution Press; 2018.</li>
</ul></td></tr>
</table>

| | |
|---|---|
| | • NIST. The NIST Cybersecurity Framework (CSF) 2.0. National Institute of Standards and Technology; 2024. Available from: https://www.nist.gov/cyberframework.<br>• Quinn B. Data Protection Implementation Guide: A Legal, Risk and Technology Framework for the GDPR. Alphen aan den Rijn: Wolters Kluwer; 2021.<br>• Spinello RA. Cyberethics: Morality and Law in Cyberspace. 7th ed. Burlington: Jones & Bartlett Learning; 2020.<br>• Stallings W, Brown L. Computer Security: Principles and Practice. 4th ed. Pearson; 2018.<br>Recommended certification<br>ISO 27001: information system security certification<br>Supplementary Resources<br>• ENISA. Threat Landscape Report. [Internet]. European Union Agency for Cybersecurity; 2024 Available from: https://www.enisa.europa.eu/topics/cyber-threats/threats-and-trends<br>• Meeuwisse R. Cybersecurity for Beginners. 2nd ed. Cyber Simplicity Ltd; 2017.<br>• Owens J, Griffiths P. The DevOps Handbook: How to Create World-Class Agility, Reliability, & Security in Technology Organizations. IT Revolution Press; 2016.<br>• Sarker IH, Kayes ASM, Badsha S, et al. Cybersecurity data science: an overview from machine learning perspective. J Big Data. 2020; 7:41.<br>• Stallings W. Information Privacy Engineering and Privacy by Design: Understanding Privacy Threats, Technology, and Regulations Based on Standards and Best Practices. 1st ed. Boston: Addison-Wesley Professional; 2019. |

## Cloud Computing for Business

<table>
<tr><td>Module designation</td><td>Cloud Computing for Business</td></tr>
<tr><td>Semester(s) in which the module is taught</td><td><table>
<tr><td>Full Time</td><td>Semester 1, Semester 2 (Year 1)</td></tr>
<tr><td>Part Time</td><td>Semester 1, Semester 2 (Year 1)<br>Semester 1, Semester 2 (Year 2)</td></tr>
</table></td></tr>
<tr><td>Partner responsible for the module</td><td><u>NCI</u></td></tr>
<tr><td>Person responsible for the module</td><td>Adriana E. Chis</td></tr>
<tr><td>Language</td><td>English</td></tr>
<tr><td>Relation to curriculum</td><td>Elective</td></tr>
<tr><td>Teaching methods</td><td>The teaching methodology for this module will include the following approaches:<ul><li>Hybrid Learning: A combination of accessible synchronous (e.g., live online lectures and discussions) and asynchronous (e.g., video lectures, case studies, individual study activities) content.</li><li>Problem-Based Learning: Students work on practical case studies and business scenarios with a focus on driving digital business transformation in a cloud-enabled business context.</li><li>Laboratory activities: Develop proposals for concrete business problems/scenarios for the adoption of cloud computing solutions within an organisation.</li><li>Flipped Classroom: First, students study independently teaching materials and/or video content prior to attending the synchronous live classes. Next, during live classes time will be allocated to discussions, practical exercises, and group work.</li></ul></td></tr>
<tr><td>Workload (incl. contact hours, self-study hours)</td><td><table>
<tr><td>Classroom & Demonstrations (hours)</td><td>36</td></tr>
<tr><td>Other hours (Practical work /Tutorial)</td><td>24</td></tr>
<tr><td>Independent learning (hours)</td><td>190</td></tr>
<tr><td>Total (hours)</td><td>250</td></tr>
</table></td></tr>
<tr><td>Credit points</td><td>10 ECTS</td></tr>
</table>

| | |
|---|---|
| **Recommended prerequisites for joining the module** | 1. Analytical thinking and problem-solving skills<br>2. Basic understanding of digital technologies, organizational processes, and business operations |
| **Module objectives/intended learning outcomes** | The Cloud Computing for Business module aims to provide a comprehensive coverage of Cloud Computing technologies and addresses the potential impact, challenges, and benefits of these technologies in the context of digital business transformation. Students will explore the essentials of Cloud Computing and its role in digital business transformation, assessing core principles, frameworks, and methodologies, along with the tools necessary for implementing Cloud Computing solutions effectively.<br>The module will touch upon governance and security challenges of cloud-based systems, guiding students to identify and evaluate various cloud security architectures and deployment strategies. The module also covers a broad spectrum of existing and emerging cloud services, including storage, machine learning, compute, analytics, and quantum computing. Students will learn to critically appraise these services and develop strategies to harness their potential for driving digital business transformation, equipping them with the knowledge to make informed decisions in a cloud-enabled business landscape.<br><br>Upon successful completion of this module, learners will be able to:<br>**LO1:** Assess core principles, frameworks, development methodologies and tools for the adoption of Cloud Computing solutions to support and enable digital business transformation.<br>**LO2:** Critically analyse the governance and security challenges associated with cloud-based systems to identify and evaluate candidate cloud security architectures and deployment strategies.<br>**LO3:** Evaluate and assess the intersection and impact of Fog and Edge Computing in relation to Cloud Computing.<br>**LO4:** Critically appraise the wide range of existing and emerging cloud services (e.g., storage, machine learning, compute, analytics, quantum computing, etc.) and develop strategies to leverage such services for digital business transformation. |

<table>
<tr><td>Content</td><td>Cloud Computing for Business is a 10 ECTS module delivered over 5 hours per week for 12 weeks. An indicative schedule of topics to be addressed each week is outlined below:
<table>
<tr><th></th><th>Lecture Topic</th><th>Lecture Detail</th></tr>
<tr><td>1</td><td>Cloud Computing Introduction</td><td>Foundations. Defining Cloud Computing. Service Models. Deployment Models Cloud Technologies.</td></tr>
<tr><td>2</td><td>Enterprise Digital Architecture & Digital Transformation</td><td>Enterprise Systems Architecture. Functional/Non-functional architectural requirements. Information & Applications. Opportunities/Challenges. Business Model Innovation. Digital Transformation as a staged process. Business Readiness.</td></tr>
<tr><td>3</td><td>Cloud Strategy for Digital Transformation</td><td>Alignment with Business Goals. Key Performance Indicators (KPIs). Service Level Agreements (SLAs). Innovation. Enterprise Architecture on the Cloud. Performance. Interoperability. Scalability. Availability. Mobility. Analyticity. Usability.</td></tr>
<tr><td>4</td><td>Cloud Adoption</td><td>Cloud Adoption Frameworks. Organisational Change Management. Migration Scenarios. Hybrid Model. DevSecOps.</td></tr>
<tr><td>5</td><td>Cloud Security I</td><td>Cloud Security Concepts. Infrastructure as a Service (IaaS)/ Platform as a Service (PaaS)/ Software as a Service (SaaS) Security. Identity and Access Management (IAM).</td></tr>
<tr><td>6</td><td>Cloud Security II</td><td>Intrusion Detection/Incident Response. Encryption/Key Management Service (KMS). Disaster Recovery/Business Continuity.</td></tr>
<tr><td>7</td><td>Cloud Native</td><td>Cloud Native concepts. Architectural Considerations. Microservices/Events/Streams/Application Programming Interfaces (APIs)/Data. Impact on development / deployment. Impact on organisational structures / processes. Context-specific Patterns. Automation & Orchestration.</td></tr>
<tr><td>8</td><td>Capacity Assessment & Optimisation</td><td>Resource Utilisation. Information Lifecycle Management. Elasticity. Economic Considerations.</td></tr>
<tr><td>9</td><td>Scope of Cloud Services</td><td>Scope of Cloud Service Offerings. Data Services. Big Data Analytics. AI & ML Services. Internet of Things (IoT) Services. Quantum Computing Services.</td></tr>
<tr><td>10</td><td>Fog & Edge Computing</td><td>Architectural approaches to IoT and Edge Computing. Fog and Edge Architectures, (e.g., OpenFog Reference Architecture). Network Function Virtualization (NFV). Software Defined Networking (SDN). Recommendations</td></tr>
</table></td></tr>
</table>

<table>
<tr><td></td><td>
<table>
<tr><td></td><td></td><td>of the National Institute of Standards and Technology (NIST).</td></tr>
<tr><td>11</td><td>Cloud Governance</td><td>Data Protection & Privacy on the cloud. Regulatory Compliance & Legal Aspects.</td></tr>
<tr><td>12</td><td>Emerging Topics in Cloud Computing</td><td>State-of-the-art research. Contemporary focus on Cloud Computing.</td></tr>
</table>
</td></tr>
<tr><td>Exams and assessment formats</td><td>Both formative (ongoing) and summative (final) assessments will be employed in the module to enable and to measure students' progress respectively. Formative assessments can provide feedback to enable students to improve their overall study pathway.<br>The assessments are carefully designed to cover and to evaluate the module's learning outcomes and to foster the development of both technical and transferable skills. The summative assessment will address all the module's learning outcomes and will evaluate the students' knowledge, skills, and competences. Clear assessment rubric and criteria will be created, indicating how students will be assessed against attainment of learning objectives.
<table>
<tr><th>Assessment Type</th><th>Assessment Description</th><th>Outcome addressed</th><th>% of total</th><th>Assessment Date</th></tr>
<tr><td>Project</td><td>Project focusing on developing a strategy and business case for the adoption of cloud computing solutions within an organisation.</td><td>LO1, LO2, LO3, LO4.</td><td>100%</td><td>Week 12</td></tr>
</table>
</td></tr>
<tr><td>Study and examination requirements</td><td>Students must have an overall final grade of 40% or higher to pass this module.</td></tr>
<tr><td>Reading list</td><td><u>Recommended Resources</u><br>• Comer D. The Cloud Computing Book: The Future of Computing Explained. 1st ed. Boca Raton: Chapman and Hall/CRC; 2023.</td></tr>
</table>

| | |
|---|---|
| | • Dotson C. Practical Cloud Security: A Guide for Secure Design and Deployment. 2nd ed. O'Reilly Media; 2023.<br>• Faynberg I, Lu H-L, Skuler D. Cloud Computing: Business Trends and Technologies. 1st ed. Hoboken: Wiley; 2016.<br>• Gregor H, Woolf B. Enterprise Integration Patterns: Designing, Building, and Deploying Messaging Solutions. 1st ed. Boston: Addison-Wesley; 2003.<br>• Hwang K. Cloud Computing for Machine Learning and Cognitive Applications. Cambridge: The MIT Press; 2017.<br>• Linthicum D. An Insider's Guide to Cloud Computing. 1st ed. Boston: Addison-Wesley Professional; 2023.<br>• Marinescu DC. Cloud Computing: Theory and Practice. 3rd ed. San Diego: Morgan Kaufmann; 2022.<br>• Millard C, editor. Cloud Computing Law. 2nd ed. Oxford: Oxford University Press; 2021.<br><br>Supplementary Resources<br>• Armbrust M, et al. Above the Clouds: A Berkeley View of Cloud Computing. EECS Department, University of California, Berkeley, Technical Report No. UCB/EECS-2009-28; 2009 Available from: http://www2.eecs.berkeley.edu/Pubs/TechRpts/2009/EECS-2009-28.pdf<br>• Buyya R, et al. A Manifesto for Future Generation Cloud Computing: Research Directions for the Next Decade. ACM Comput. Surv. 2019;51(5): 105:1-105:38.<br>• Cao K, Liu Y, Meng G, Sun Q. An Overview on Edge Computing Research. IEEE Access. 2020; 8:85714-85728.<br>• Baldini I, et al. Serverless Computing: Current Trends and Open Problems, In: Chaudhary S., Somani G., Buyya R. (eds) Research Advances in Cloud Computing. Springer, Singapore. 2017. Available from: https://link.springer.com/chapter/10.1007/978-981-10-5026-8_1<br>• Castro P, Ishakian V, Muthusamy V, Slominski A. The Rise of Serverless Computing. Comm. ACM. 2019;62(12):44-54.<br>• Govind H, González-Vélez H. Benchmarking Serverless Workloads on Kubernetes. CCGRID 2021;704-712.<br>• Jonas E, et al. Cloud Programming Simplified: A Berkeley View on Serverless Computing. Technical Report No. UCB/EECS-2019-3; 2019. Available from: https://www2.eecs.berkeley.edu/Pubs/TechRpts/2019/EECS-2019-3.html<br>• Mao Y, You C, Zhang J, Huang K, Letaief KB. A Survey on Mobile Edge Computing: The Communication Perspective. IEEE Communications Surveys & Tutorials. 2017;19(4):2322-2358. |

Digital 4 Business

Evolving your digital future

**Legal Disclaimer**

*The European Commission's support to produce this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.*

Project 101084013 — Digital4Business — DIGITAL-2021-SKILLS-01