Exponential University of applied sciences

Short Module Manual

Coding and Software Engineering B.Sc.

XU Exponential University of Applied Science

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SHORT FACTS

Graduation	Bachelor of Science	**Type of Study**	Full-time
Scope	180 ECTS	**Total numbers of semesters**	6 semesters
Language	English	**Matriculation Date**	Every Semester

Teaching method Seminars in small groups, additional excursions, case studies, integration into practice

Course and content of studies

SEMESTER 1

CO 1 Code Red – Coding in Action — **5 ECTS** portfolio exam

- **Code of Conduct – Rules and Regulations:** History of programming, quality criteria, programming languages and -methods, data types and operators, formulation of algorithms, OOP in Swift, GUI programming, parallel sequences
- **Code of Practice – Nano Project Bootcamp (Web|Apps|Games):** application of the rules and regulations taught in CO 1.1

SE 1 Agile Project Development — **5 ECTS** term paper

- **Software Engineering Process:** Phases of software engineering, classical procedures and process models etc., agile software engineering, agile manifesto and core values, overview of other agile methods
- **Lean Software Development:** History and application areas, procedure, roles, meetings, artifacts, principles

IT 1 Introduction to IT and Computer Sciences — **5 ECTS** written exam

- **Computer Sciences:** Historical development, categorization and classification of computer science, storage and interpretation of information, hardware components, operating systems, application programs, processor architectures, memory and cache
- **Computer Networks:** Computer networks, ethernet and the internet, database systems

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SEMESTER 1

IM 1 Digital Transformation — 5 ECTS, portfolio exam

- **Disruptive Innovations:** Basic concepts, challenges and requirements of transformation, digital future markets, Internet of Things, human communication, generations of digitization
- **Digital Solutions:** Economy – new business models, technology – new applications in hardware and software, communication – new approaches to communication and collaboration, work and life – forms/structures and processes

QM 5 Quantitative Methods 1 — 5 ECTS, written exam

- **Discrete Mathematics:** Fundamentals, relations and functions, sequences and series, combinatorics, recursion and growth of algorithms
- **Linear Algebra:** Vector spaces, linear maps and matrices, linear equations, linear optimization, Scalar product

SK 1 Academic Skills — 5 ECTS, portfolio exam

- **Scientific Work:** basics of scientific work, problem definition, structure, citation, data, literature
- **Text and Data Processing:** formatting in Word, data processing in Excel, statistical work with Excel

SEMESTER 2

CO 2 Junior Web Development — 5 ECTS, portfolio exam

- **Web Development Lab:** Web Development languages, HTML5, CSS3, server environment, database, browser, widgets, speed and stability, security
- **Web Development Project (Website|Webservice|API):** Selection of project content, drafting a project plan, project work

SE 2/1 Project Planning and Programming — 5 ECTS, see SE 2/2

- **Analysis, Planning and Prototyping:** Creation and refinement of a product backlog, definition and implementation of sprints, Daily Scrum
- **Programming, Validation and Verification:** Sprints, processing of tasks, sprint review and -retrospective

IT 2 Database Systems — 5 ECTS, portfolio exam

- **Data Management:** Purpose/Tasks of data management, Business Intelligence and Data Warehouse, Big Data, Data Quality
- **Databases and Database Applications:** Databases and database systems, relational databases and introduction to SQL, Big Data-technologies

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SEMESTER 2

IM 2 Cooperation (Cooperation and Communication) — 5 ECTS, presentation

- **Collaboration Tools:** Work and organization design in industry 4.0, concepts and conditions of cooperation, tools and platforms
- **Communication Tools – Effective Corporate Networks:** communication media on the internet, social media, referral marketing

QM 6 Quantitative Methods II — 5 ECTS, written exam

- **Graph Theory:** Introduction, trees, search methods, design methods for graph theory, coloring, flows, paths
- **Analysis:** Basics, differential calculus I and II, integral calculus, Fourier series

SK 2 Communication Skills — 5 ECTS, presentation

- **Communication and Presentation:** Basics, models, functions and types of communication, presentation basics, society and media reality
- **Moderation Workshop:** Basics, preparation and follow-up of the moderation, implementation, dealing with conflicts

SEMESTER 3

CO 3 Junior App Development — 5 ECTS, code and documentation

- **App Development Lab:** History, app development languages and platforms, system software, licenses and costs, speed and stability, security
- **App Development Project (iOS|Android):** Selection of project content, creation of project plan, project work for iOS or Android in Swift or Java

SE 2/2 Project Configuration and Implementation — 5 ECTS, code and documentation

- **Quality and Configuration Management:** Continuation of the Scrum process, impediment backlog
- **Implementation and Documentation:** Finalization of the Scrum process, product increment, burndown graphics, Def. of Done

IT 3 Data Structures — 5 ECTS, written exam

- **Data Structures and Algorithms:** Basics, sorting, search, strings, hash procedures, quantity manipulation, further algorithm design techniques, geometric algorithms, graph algorithms
- **Data Structures and Algorithms Tutorial:** repetition of essential contents of IT 3.1, explanation/execution of exercises

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SEMESTER 3

IM 3 Interaction (Costumer Interaction - UX) — 5 ECTS, case study

- **UX User Experience Design:** User experience design, brainstorming, business analysis, user research, requirements and requirement management, information architecture, visual design, interaction design and concept, usability testing, lean UX
- **Human-computer-interaction:** Basics of human information processing, perception, cognition, motor skills, hardware and software for interaction, technological basics, embedded computer, social engineering, standards/laws and guidelines

QM 7 Quantitive Methods III — 5 ECTS, written exam

- **Probability Theory:** probabilities, random variables, probability distributions
- **Statistics:** key figures/values of a sample, estimation methods, inspection methods, correlation and regression

SK 4 Interaction Skills / Team Building — 5 ECTS, presentation

- **Team Management:** Roles in a team, role/tasks of a team leader, team building, a framework for action, leadership
- **Conflict Management and Mediation:** Types and diagnosis of conflicts, conflict resolution, mediation, case studies/ training

SEMESTER 4

Study Abroad Semester — 20 ECTS

- **In accordance with the guidelines of the partner universities, there is the possibility of acquiring and deepening intercultural experience, setting professional priorities, and developing language and personal skills.**

Internship — 10 ECTS, internship report

- **Internship in a professionally appropriate field**

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SEMESTER 5

IT 5 Cloud Computing — 5 ECTS, written exam

- **Cloud Computing Architectures:** Classification and distinction, service levels, forms of organization/architecture, technical aspects, legal basics, opportunities and risks, IT strategy and cloud, cloud and security
- **Cloud Computing Applications:** Interaction of clouds, cloud provider – offer, service, advantages and disadvantages, private cloud, apps and devices

IM 4 Innovation — 5 ECTS, oral exam

- **Innovation Management:** Definition of innovation management, corporate strategy and goals, innovation processes, types of innovations, evaluation/assessment, intersections within the company, implementation and anchoring
- **Innovation Techniques Workshop:** Innovation techniques and -methods (design thinking, lean start-up, TRIZ, mind-mapping, future workshop, SPRINT, open space, P2S among others)

BM 5 Ethics and Law — 5 ECTS, written exam

- **Business Ethics:** Fundamentals and the need for business ethics, basic positions, economic ethical paradigms, moral actions, ethical decision making, ethical dilemmas in management decisions, decent business management, IT and ethics
- **Business Law:** Fields of law and legal foundation, German Civil Code (BGB), commercial transactions, contract design, contract types according to the BGB and contract forms, special features of international treaties, company law, case studies

BT 1 Bachelor Thesis Set-up — 5 ECTS, presentation

- **Preparation Bachelor Thesis:** Literature vs. empirical work, scientific-ethical quality criteria, scientific fields, subject, planning and implementation, material research, -selection and -evaluation, revision of formal requirements and -citation methods
- **Bachelor Thesis Reflection /Coaching:** Professional support throughout the planning and development of the thesis, advice on all scientific formalities and related matters, concept presentation

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SEMESTER 6

IT 4 Data Security — 5 ECTS, portfolio

- **Data Security:** Objectives of data security, legal statutes and regulations, safety concept, risks and uncertainties, data storage, data loss and recovery, authentication, roles and rights concept, networks and network protocols, security in networks, VPN
- **Cyber Security:** Cryptographic principles and methods and data encryption, attacks and vulnerabilities, antivirus, firewall, sandbox, cybercrime, safety concept

IM 5 Organization — 5 ECTS, case study

- **Organizational Agility – Agile Organizations:** Innovation and change management, corporate culture, agile principles, -values and -leadership, communication, scrum – agile project management, limits, and dangers
- **Organizational Productivity – Innovative Organizational Cultures:** Basics of productivity, Beyond budgeting, fields of beyond budgeting or better management, implementation, possibilities, limits and dangers

BT 2 Bachelor Thesis — 10 ECTS, thesis

- **Independent preparation of the Bachelor Thesis**

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SEMESTER 5/6

ELECTIVE MODULES IN 5th AND 6th SEMESTER

2 specializations must be selected. The realization of the elective modules depends on a minimum number of participants

EL 29/30 Senior Web Development I (Portfolio Sites) & II

per 5 ECTS
portfolio exam
portfolio

- **Responsive Web Design:** Basics and differentiation, requirements of devices, frameworks, web standards, programming languages (HTML5, CSS3, possibly add. languages, if necessary, e.g. PHP), general requirements, concept creation
- **Responsive Images:** Layout options, responsive media, planning, concept creation images/videos
- **Interactive Web Design:** Principles and differentiation, requirements of devices, programming languages, general conditions, 3D programming, concept creation
- **Data Interchange Formats (JSON):** Definition and differentiation, integration into programming languages, -websites and -apps, possible applications, security of data exchange, project

EL 31/32 Senior App Development I (Game Concept) & II

per 5 ECTS
portfolio exam
code and documentation

- **Gameplay, Mechanism and Balancing Lab:** Game Design, historical milestones in game development, fields within game design, game mechanics, gameplay, scope- level design, balancing, UI, interaction and interface
- **Game Concept Project:** Game development process, creation of a game concept and according time schedule
- **Design Patterns and Programming Languages Lab:** Software architecture, programming languages, design patterns
- **Game App Development Project:** Implementation of the game concept from the course 31.2

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SEMESTER 5/6

EL 33/34 Usability Engineering I (Computer Graphics) & II

per 5 ECTS
term paper
code and documentation

- **Image Types (2D, 3D, Computer Animation):** Basics (general terms, image editing, processing, computer graphics, human vision, photo sensors), file formats, 2D, 3D, animation
- **Image Processing Techniques and Principles:** The digital image, principles of image processing, creating/editing graphics in 2D (Gimp), 3D and animations (Unity), applications
- **Usability Dialogues and Interaction Design:** Usability and usability methods, interaction design, interface design, service design, visual design, goal-oriented design, dialogue concept development
- **Usability testing and Prototyping Project:** Implementation of the concept from the course 34.1

EL 35/36 Mobility Management and Techniques I & II

per 5 ECTS
respective term paper

- **Mobile and Wireless Communication:** History and milestones of mobile communication, systems, national and international special features, protocols, security, creation of communication concepts (national, EU, worldwide)
- **Mobile Device Management:** History and milestones of mobile devices, smartphones, pads and tablet computers, operating systems, mobile device management, business continuity vs. mobile device management and - management system, security
- **Mobile Security:** Data security technology, network security, secure wireless and mobile communication, protection of communication infrastructure, hacking and protection against attacks
- **Mobile Communication Concept Project:** Basics of a communication concept, content of a mobile communication concept, calculation of solutions, creation of the concept

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SEMESTER 5/6

EL 37/38 Artificial Intelligence I & II

per 5 ECTS
portfolio exam
portfolio exam

- **AI Fundamental Algorithms:** Introduction and history of AI, normalization, distance metrics, random number generation, K-Means clustering, error calculation, towards Machine Learning, optimization training, linear regression
- **AI Nature-Inspired Algorithms:** Population, scoring and selection, crossover and mutation, genetic algorithms and programming, speciation, particle swarm- and ant colony optimization, cellular automata, artificial life, modeling
- **AI Deep Learning and Neural Networks:** Neural network basics, self-organizing maps, Hopfield & Boltzmann machines, feedforward neural networks, training & evaluation, back propagation training, NEAT, CPPN & HyperNEAT, deep learning
- **AI Applications:** Current applications (games, financial markets, social media, search engines etc.)

EL 39/40 Data Warehouse I & II

per 5 ECTS
term paper
presentation

- **Data Warehouse Architecture:** Differentiation and classification, reference- and physical architecture, data warehouse systems, data warehouse project
- **Data Organization/ Collection and Integration:** Modelling of the basic database, multidimensional data model (planning and implementation), optimization of the database, operation and further development
- **Data Mining and Data Processing:** Basics data and relations, data processing, application classes, classification, legal and moral aspects
- **Visualized Reporting:** Contents and purpose of a reporting, data visualization, selection of the right visualization, tasks

EL 41/42 Digital Management and Consulting I & II

per 5 ECTS
written exam
case study

- **Business Process Management:** Basics of process management, application areas of business process management in ERP, PPS, SCM and CRM, business processes in companies, modeling and automation of business processes, BPM, project work
- **Transaction Process Systems/ ERP Systems:** Practical introduction to ERP systems using the example of SAP ERP, customization – organization and processes, debugging
- **Business Consulting Skills:** Traditional project management, self-management, consulting and advice, ethical standards, analysis, defining tasks/problems, strategy development, implementation, project completion
- **Business Consulting Project:** Working on a case study regarding a given topic

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SEMESTER 5/6

EL 43/44 Business Management I & II

per 5 ECTS
written exam
presentation

- **Human Resources Management:** Theoretical foundations, actors-, conditions and instruments of human resources management, personnel controlling
- **Organization:** Basics and organizational theories, organizational design, informal organization, change of organizations
- **Marketing:** Development and concepts of marketing, marketing theory, marketing mix, buyer behavior research as the basis of marketing management, explanatory approaches to buyer behavior, marketing research and sales forecast
- **Budgeting/ Pricing:** Definition of the term budget, Budgeting types, Project budget, controlling, pricing, price calculations and -systems

EL 11/12 Digital Research and Development I & II

per 5 ECTS
portfolio exam
presentation

- **Data Mining:** Relevant data, databases and information, big data, smart data, knowledge discovery in databases, data mining, exercises
- **Forecasting:** Prediction vs. reporting, predicting customer choice, targeting current customers, predicting sales
- **Product Development:** Strategic product development, requirements analysis, determining product requirements, customer benefits as product profiles, generation-, selection-, evaluation- and presentation of product idea, industrial property rights
- **Research and Development Project:** Steps of the product development process, practical development work, presentation, documentation, evaluation

IN TOTAL : 180 ECTS

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