Subjects Modules for S5

Artificial Intelligence and Data Analytics

Semester 1 Year 3

U5.1: Analysis and Optimization Methods

Time Series Analysis

Module designation	**Analysis and Optimization Methods**
Module level, if applicable	Year 3, Semester 1
Code, if applicable	U5.1
Subtitle, if applicable	
Courses, if applicable	**Time Series Analysis**
Semester(s) in which the module is taught	Semester 5
Person responsible for the module	Dept Head
Lecturer	Mr. Anouar Ben Messaoud
Language	Frensh
Relation to curriculum	Compulsory module
Type of teaching, contact hours	21 hours Lecture/ semester 21 hours practical workshop in Lab/ semester
Workload	Total 63 hours/ Semester (21 hours of Self Study)
Credit points	3
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Familiarity with Python or R programming Prior exposure to basic data analysis and visualization
Module objectives/intended learning outcomes	**Objectives:** To introduce the fundamental techniques for analyzing, modeling, and forecasting time-dependent data using statistical and machine learning approaches. **Learning outcomes:** By the end of this course, students will be able to: • Understand the structure and challenges of time series data • Apply classical statistical models (ARIMA, SARIMA) • Evaluate and compare forecasting methods
Content	**Chapter 1: Introduction to Time Series Data** 1. Definitions, types of time series (univariate, multivariate) 2. Components: trend, seasonality, noise **Chapter 2: Exploratory Analysis of Time Series** 1. Visualization techniques 2. Autocorrelation and stationarity

	Chapter 3: Time Series Preprocessing 1. Resampling, smoothing, differencing 2. Handling missing values and outliers **Chapter 4: Classical Time Series Models** 1. AR, MA, ARMA, ARIMA 2. Seasonal models: SARIMA **Chapter 5: Forecasting Techniques** 1. Rolling forecasts, cross-validation 2. Evaluation metrics (MAE, RMSE) **Chapter 6: Advanced Methods** 1. Exponential smoothing (Holt-Winters) 2. State-space models and Kalman filter **Chapter 7: Machine Learning for Time Series** 1. Feature-based approaches 2. Recurrent Neural Networks (LSTM basics)
Study and examination requirements and forms of examination	Written Mid-Term Exam (40%) + Written Final Exam (60%)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online(Moodle ULT) Video projection
Reading list	1. Hyndman & Athanasopoulos – Forecasting: Principles and Practice 2. Chatfield, C. – The Analysis of Time Series: An Introduction 3. Box, Jenkins, Reinsel – Time Series Analysis: Forecasting and Control

U5.1: Analysis and Optimization Methods

Optimization and Heuristics

Module designation	**Analysis and Optimization Methods**
Module level, if applicable	Year 3, Semester 1
Code, if applicable	U5.1
Subtitle, if applicable	
Courses, if applicable	**Optimization and Heuristics**
Semester(s) in which the module is taught	Semester 5
Person responsible for the module	Dept Head
Lecturer	Ms. Amira Brahmi
Language	Frensh
Relation to curriculum	Compulsory module
Type of teaching, contact hours	21 hours Lecture/ semester 21 hours practical workshop in Lab/ semester
Workload	Total 63 hours/ Semester (21 hours of Self Study)
Credit points	3
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Introduction to algorithms and complexity Basic understanding of discrete mathematics
Module objectives/intended learning outcomes	**Objectives:** To provide students with a solid foundation in optimization techniques and heuristic methods for solving complex real-world problems where exact solutions are difficult or infeasible to obtain **Learning outcomes:** By the end of this course, students will be able to: • Formulate and analyze optimization problems • Apply classical and heuristic-based optimization methods • Implement metaheuristic algorithms for real-world problems
Content	**Chapter 1: Introduction to Optimization** 1. Types of optimization problems 2. Linear vs. non-linear, discrete vs. continuous **Chapter 2: Classical Optimization Methods** 1. Linear Programming (Simplex Method) 2. Integer and Mixed-Integer Programming 3. Gradient-based methods

	Chapter 3: Metaheuristics Overview 1. Characteristics and use cases 2. Exploration vs. exploitation **Chapter 4: Local Search and Variants** 1. Hill Climbing, Simulated Annealing 2. Tabu Search **Chapter 5: Evolutionary Algorithms** 1. Genetic Algorithms 2. Selection, crossover, mutation **Chapter 6: Swarm Intelligence** 1. Particle Swarm Optimization 2. Ant Colony Optimization **Chapter 7: Hybrid and Multi-Objective Optimization** 1. Combining heuristics 2. Pareto optimality
Study and examination requirements and forms of examination	Written Mid-Term Exam (40%) + Written Final Exam (60%)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online(Moodle ULT) Video projection
Reading list	1. Michalewicz, Z. – Genetic Algorithms + Data Structures = Evolution Programs 2. Kenneth S. Leung – Metaheuristics: From Design to Implementation 3. Rardin, Ronald L. – Optimization in Operations Research 4. Deb, Kalyanmoy – Multi-Objective Optimization Using Evolutionary Algorithms

U5.2: Advanced AI

Natural Language Processing

Module designation	**Advanced AI**
Module level, if applicable	Year 3, Semester 1
Code, if applicable	U5.2
Subtitle, if applicable	
Courses, if applicable	**Natural Language Processing**
Semester(s) in which the module is taught	Semester 5
Person responsible for the module	Dept Head
Lecturer	Ms. Zahra Kodia
Language	Frensh
Relation to curriculum	Compulsory module
Type of teaching, contact hours	21 hours Lecture/ semester 21 hours of Supervised projects on Campus/ semester
Workload	Total 84 hours/ Semester (42 hours of Self Study)
Credit points	3
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Basic programming skills (Python) Foundations of linear algebra and probability Introductory machine learning concepts
Module objectives/intended learning outcomes	**Objectives:** To introduce students to the fundamental concepts, techniques, and tools for processing and understanding human language using computational methods **Learning outcomes:** By the end of this course, students will be able to: • Understand and implement key NLP techniques • Preprocess and represent text for machine learning models • Apply classical and deep learning models to NLP tasks • Use state-of-the-art NLP frameworks and tools • Build and evaluate NLP systems for real-world problems
Content	**Chapter 1: Introduction to NLP** 1. History, applications, challenges 2. NLP pipeline overview **Chapter 2: Text Preprocessing**

	1. Tokenization, stemming, lemmatization 2. Stop word removal, POS tagging **Chapter 3: Word Representations** 1. Bag-of-Words, TF-IDF 2. Word embeddings (Word2Vec, GloVe, FastText) **Chapter 4: Syntactic and Semantic Analysis** 1. Parsing: constituency and dependency 2. Named Entity Recognition (NER), coreference resolution **Chapter 5: Language Modeling and Text Classification** 1. N-grams, RNNs, LSTMs 2. Sentiment analysis, topic modeling **Chapter 6: Transformer-based Models** 1. Attention mechanism 2. BERT, GPT and transfer learning in NLP **Applications of NLP** • Machine translation, question answering • Chatbots, summarization
Study and examination requirements and forms of examination	Continuous Assessment (50%) + Project (50%) (Report for each workshop/Project required)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online(Moodle ULT) Video projection
Reading list	1. Jurafsky & Martin – Speech and Language Processing 2. Yoav Goldberg – Neural Network Methods for NLP

U5.2: Advanced AI

Computer Vision

Module designation	**Advanced AI**
Module level, if applicable	Year 3, Semester 1
Code, if applicable	U5.2
Subtitle, if applicable	
Courses, if applicable	**Computer Vision**
Semester(s) in which the module is taught	Semester 5
Person responsible for the module	Dept Head
Lecturer	Mr. Mohamed Anouar Ben Messaoud
Language	Frensh
Relation to curriculum	Compulsory module
Type of teaching, contact hours	21 hours Lecture/ semester 21 hours of Supervised projects on Campus/ semester
Workload	Total 84 hours/ Semester (42 hours of Self Study)
Credit points	3
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Basic programming skills (preferably in Python) Linear algebra and matrix operations Introductory knowledge of machine learning
Module objectives/intended learning outcomes	**Objectives:** To introduce students to the core principles, techniques, and tools used in computer vision to enable machines to perceive and interpret visual data from the world **Learning outcomes:** By the end of this course, students will be able to: • Understand the fundamentals of image processing and analysis • Implement classical and deep learning-based computer vision algorithms • Apply feature extraction, detection, and object recognition techniques • Use libraries like OpenCV, TensorFlow/Keras, or PyTorch for vision tasks
Content	**Chapter 1: Introduction to Computer Vision** 1. Applications and challenges 2. Image formation and representation **Chapter 2: Image Processing Fundamentals**

	1. Filtering, edge detection, histograms 2. Morphological operations **Chapter 3: Feature Detection and Matching** 1. SIFT, SURF, ORB 2. RANSAC and homographies **Chapter 4: Object Detection and Recognition** 1. Haar cascades, HOG + SVM 2. YOLO, SSD, Faster R-CNN (intro) **Chapter 5: Image Segmentation** 1. Thresholding, region growing 2. Semantic and instance segmentation **Chapter 6: Deep Learning for Vision** 1. CNNs for image classification 2. Transfer learning and pre-trained models
Study and examination requirements and forms of examination	Continuous Assessment (50%) + Project (50%) (Report for each workshop/Project required)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online(Moodle ULT) Video projection
Reading list	1. Richard Szeliski – Computer Vision: Algorithms and Applications 2. Simon J.D. Prince – Computer Vision: Models, Learning, and Inference 3. Adrian Rosebrock – Practical Python and OpenCV 4. OpenCV Documentation – https://docs.opencv.org

U5.2: Advanced AI

Generative AI

Module designation	**Advanced AI**
Module level, if applicable	Year 3, Semester 1
Code, if applicable	U5.2
Subtitle, if applicable	
Courses, if applicable	**Generative AI**
Semester(s) in which the module is taught	Semester 5
Person responsible for the module	Dept Head
Lecturer	Mr. Anis Chedli
Language	Frensh
Relation to curriculum	Compulsory module
Type of teaching, contact hours	21 hours Lecture/ semester 21 hours of Supervised projects on Campus/ semester
Workload	Total 84 hours/ Semester (42 hours of Self Study)
Credit points	3
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Solid understanding of machine learning and deep learning Familiarity with neural networks (CNNs, RNNs) Proficiency in Python and libraries like TensorFlow or PyTorch
Module objectives/intended learning outcomes	**Objectives:** To introduce students to the principles, models, and tools of generative AI, enabling them to understand, build, and evaluate systems that can create content such as text, images, audio, and code **Learning outcomes:** By the end of this course, students will be able to: • Understand key generative models and their architectures • Implement and train generative models using modern frameworks • Apply generative AI to tasks in NLP, vision, and multimodal systems
Content	**Chapter 1: Introduction to Generative AI** 1. What is generative AI? Use cases and ethical considerations 2. Discriminative vs. generative models **Chapter 2: Generative Models Overview** 1. Probabilistic models and latent variables

	2. Variational Autoencoders (VAE) 3. Generative Adversarial Networks (GANs) **Chapter 3: Text Generation** 1. Language models: GPT, T5 2. Prompt engineering and fine-tuning 3. Applications: summarization, translation, chatbots **Chapter 4: Image and Audio Generation** 1. StyleGAN, Diffusion Models (e.g., Stable Diffusion) 2. Audio synthesis with WaveNet and MusicLM **Chapter 5: Multimodal Generative AI** 1. Text-to-image (DALL·E, Midjourney) 2. Vision-language models (CLIP, Flamingo) **Chapter 6: Ethics and Challenges** 1. Deepfakes, misinformation 2. Bias and fairness in generative models **Project** • Build and deploy a generative model for text, image, or audio
Study and examination requirements and forms of examination	Continuous Assessment (50%) + Project (50%) (Report for each workshop/Project required)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online(Moodle ULT) Video projection
Reading list	1. Ian Goodfellow et al. – Deep Learning (for GANs) 2. David Foster – Generative Deep Learning, O'Reilly 3. OpenAI Research Papers – https://openai.com/research

U5.3: Intelligent Systems

Federated Learning

Module designation	**Intelligent Systems**
Module level, if applicable	Year 3, Semester 1
Code, if applicable	U5.3
Subtitle, if applicable	
Courses, if applicable	**Federated Learning**
Semester(s) in which the module is taught	Semester 5
Person responsible for the module	Dept Head
Lecturer	Mr. Omar Khouaja
Language	English
Relation to curriculum	Compulsory module
Type of teaching, contact hours	21 hours Lecture/ semester
Workload	Total 42 hours/ Semester (21 hours of Self Study)
Credit points	2
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Solid understanding of machine learning and deep learning Familiarity with gradient descent and neural networks
Module objectives/intended learning outcomes	**Objectives:** To introduce students to federated learning techniques that enable decentralized model training across distributed devices while preserving data privacy and security **Learning outcomes:** By the end of this course, students will be able to: • Understand the architecture and challenges of federated learning • Implement federated learning algorithms using modern frameworks • Apply techniques for privacy-preserving and communication-efficient learning
Content	**Chapter 1: Introduction to Federated Learning (FL)** 1. Motivation, use cases, and challenges 2. Centralized vs. decentralized learning **Chapter 2: Architecture and Workflow** 1. FL system components 2. Client-server model and aggregation algorithms (e.g., FedAvg)

	Chapter 3: Privacy and Security in FL 1. Differential privacy, secure aggregation 2. Attacks and defenses (e.g., poisoning, inference attacks) **Chapter 4: Communication Efficiency** **Chapter 5: Personalization and Heterogeneity** 1. Handling non-IID data 2. Local adaptation and model fine-tuning **Chapter 6: Federated Learning Frameworks**
Study and examination requirements and forms of examination	Written Mid-Term Exam (40%) + Written Final Exam (60%)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online(Moodle ULT) Video projection
Reading list	1. Brendan McMahan et al. – Communication-Efficient Learning of Deep Networks from Decentralized Data 2. Google AI Blog – Federated Learning: Collaborative Machine Learning without Centralized Training Data 3. Qiang Yang et al. – Federated Machine Learning: Concept and Applications

U5.3: Intelligent Systems

Recommender Systems

Module designation	**Intelligent Systems**
Module level, if applicable	Year 3, Semester 1
Code, if applicable	U5.3
Subtitle, if applicable	
Courses, if applicable	**Recommender Systems**
Semester(s) in which the module is taught	Semester 5
Person responsible for the module	Dept Head
Lecturer	Mr. Omar Khouaja
Language	English
Relation to curriculum	Compulsory module
Type of teaching, contact hours	21 hours practical workshop in Lab/ semester 21 hours of Supervised projects on Campus/ semester
Workload	Total 77 hours/ Semester (35 hours of Self Study)
Credit points	2
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Basic understanding of machine learning Linear algebra, probability, and statistics Familiarity with data structures and algorithms
Module objectives/intended learning outcomes	**Objectives:** To provide students with the knowledge and practical skills required to design, implement, and evaluate personalized recommender systems used across various industries **Learning outcomes:** By the end of this course, students will be able to: • Understand and compare different recommendation approaches • Build collaborative and content-based recommender systems • Apply deep learning techniques to improve recommendation quality
Content	**Chapter 1: Introduction to Recommender Systems** 1. Types and applications 2. Evaluation metrics (precision, recall, RMSE, MAP) **Chapter 2: Collaborative Filtering Techniques**

	1. User-based and item-based filtering 2. Matrix factorization (SVD, ALS) **Chapter 3: Content-Based Recommendations** 1. Feature engineering and similarity measures 2. Hybrid approaches **Chapter 4: Deep Learning for Recommendations** 1. Neural collaborative filtering 2. Embedding techniques **Chapter 5: Context-Aware and Session-Based Systems**
Study and examination requirements and forms of examination	Continuous Assessment (50%) + Project (50%) (Report for each workshop/Project required)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online(Moodle ULT) Video projection
Reading list	1. Charu Aggarwal – Recommender Systems: The Textbook 2. Francesco Ricci et al. – Recommender Systems Handbook 3. Xavier Amatriain – Practical Recommender Systems

U5.4: Project Management and Governance

Data Science Project Management and MLOps

Module designation	**Project Management and Governance**
Module level, if applicable	Year 3, Semester 1
Code, if applicable	U5.4
Subtitle, if applicable	
Courses, if applicable	**Data Science Project Management and MLOps**
Semester(s) in which the module is taught	Semester 5
Person responsible for the module	Dept Head
Lecturer	Ms Salma Bouazizi
Language	English
Relation to curriculum	Compulsory module
Type of teaching, contact hours	21 hours of Supervised projects on Campus/ semester
Workload	Total 56 hours/ Semester (35 hours of Self Study)
Credit points	2.5
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Machine Learning fundamentals Python programming and data manipulation
Module objectives/intended learning outcomes	**Objectives:** To equip students with practical skills in managing end-to-end data science and machine learning projects, using MLOps tools and best practices for scalable, reproducible, and maintainable AI solutions. **Learning outcomes:** By the end of this course, students will be able to: • Manage data science projects effectively from development to deployment • Apply MLOps principles for automation, reproducibility, and scalability • Use tools like MLflow, DVC, Docker, and Airflow in real projects
Content	**Chapter 1: Introduction to Data Science Projects** 1. Lifecycle: CRISP-DM, Team roles, scoping and KPIs 2. Agile and lean methodologies in AI projects **Chapter 2: MLOps Fundamentals** 1. CI/CD for ML pipelines 2. Model packaging, testing, and deployment

	Chapter 3: Data and Model Management 1. Data versioning (DVC), feature stores 2. Model registry and monitoring **Chapter 4: Infrastructure and Automation** 1. Containerization with Docker, orchestration with Kubernetes 2. Workflow automation (Airflow, Kubeflow Pipelines) **Chapter 5: Monitoring and Maintenance** 1. Model drift detection, retraining triggers 2. Logging, alerts, and A/B testing **Chapter 6: Security, Ethics, and Governance** 1. Responsible AI, compliance, and model explainability 2. Data privacy and security best practices
Study and examination requirements and forms of examination	Continuous Assessment (50%) + Project (50%) (Report for each workshop/Project required)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online(Moodle ULT) Video projection
Reading list	1. Mark Treveil & Alok Shukla – AI Engineering: MLOps 2. Emmanuel Raj – MLOps Engineering at Scale 3. Google – MLOps: Continuous Delivery and Automation Pipelines

U5.4: Project Management and Governance

Data Governance

Module designation	**Project Management and Governance**
Module level, if applicable	Year 3, Semester 1
Code, if applicable	U5.4
Subtitle, if applicable	
Courses, if applicable	**Data Governance**
Semester(s) in which the module is taught	Semester 5
Person responsible for the module	Dept Head
Lecturer	Ms Olfa Chelly
Language	English
Relation to curriculum	Compulsory module
Type of teaching, contact hours	21 hours Lecture/ semester
Workload	Total 42 hours/ Semester (21 hours of Self Study)
Credit points	1.5
Requirements according to the examination regulations	- Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Basic knowledge of data management concepts Understanding of databases and data warehousing
Module objectives/intended learning outcomes	**Objectives:** To provide students with the knowledge and tools necessary to implement effective data governance strategies that ensure data quality, compliance, security, and responsible usage across organizations **Learning outcomes:** By the end of this course, students will be able to: • Understand the principles and importance of data governance • Design and implement governance frameworks within organizations • Apply best practices for data quality, privacy, and compliance
Content	**Chapter 1: Introduction to Data Governance** 1. Definition, importance, and key principles 2. Data governance vs. data management **Chapter 2: Data Governance Frameworks** 1. DAMA-DMBOK, DCAM, and ISO standards

	2. Roles and responsibilities (data owners, stewards, custodians) **Chapter 3: Data Quality and Metadata Management** 1. Data profiling, cleansing, and validation 2. Metadata repositories and data catalogs **Chapter 4: Compliance and Regulatory Requirements** 1. GDPR, HIPAA, CCPA, and industry-specific regulations 2. Auditing and risk management **Chapter 5: Security, Privacy, and Ethics** 1. Data classification, access control, and anonymization 2. Ethical data usage and AI governance
Study and examination requirements and forms of examination	Written Mid-Term Exam (40%) + Written Final Exam (60%)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online(Moodle ULT) Video projection
Reading list	1. DAMA International – DAMA-DMBOK: Data Management Body of Knowledge 2. Sunil Soares – The Data Governance Imperative 3. John Ladley – Data Governance: How to Design, Deploy, and Sustain an Effective Data Governance Program

U5.5 Advanced Databases

Database Administration

Module designation	**Advanced Databases**
Module level, if applicable	Year 3, Semester 1
Code, if applicable	U5.5
Subtitle, if applicable	
Courses, if applicable	**Database Administration**
Semester (s) in which the module is taught	Semester 5
Person responsible for the module	Dept Head
Lecturer	Mr. Houssem Mahmoudi
Language	French
Relation to curriculum	Compulsory module
Type of teaching, contact hours	21 hours Lecture/ semester 21 hours practical workshop in Lab/ semester
Workload	Total 63 hours/semester (21 hours of Self-Study/semester)
Credit points	2
Requirements according to the examination regulations	Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Database fundamentals, SQL
Module objectives/intended learning outcomes	**Course Objective:** This course aims to provide students with the knowledge and skills required to install, configure, manage, monitor, and secure relational database systems. It emphasizes practical database administration tasks such as user management, performance tuning, backup and recovery, and ensuring data integrity and availability. **Learning Outcomes:** By the end of this course, students will be able to: • Install and configure a relational database system • Manage users, permissions, and security settings • Perform and automate regular backups and recovery procedures • Monitor and optimize database performance • Ensure data availability through replication and high-availability solutions • Apply auditing and compliance techniques in a secure environment

Content	**Chapter 1: Introduction to Database Administration** 5. DBA roles and responsibilities 6. Types of DBMS and architectures 7. Setting up DBMS (e.g., MySQL, PostgreSQL, Oracle) 8. Configuration files and system requirements **Chapter 2: User and Security Management** 3. Creating and managing users and roles 4. Access control, privileges, and authentication **Chapter 3: Backup and Recovery Strategies** 3. Logical vs physical backups 4. Recovery models and restore techniques **Chapter 4: Storage and Space Management** 3. Tablespaces, partitions, and datafiles 4. Monitoring disk usage **Chapter 5: Performance Tuning and Optimization** 5. Indexing, query optimization 6. Monitoring tools and performance metrics 7. Logs, alerts, and health checks 8. Automating tasks with schedulers or cron jobs **Chapter 6: High Availability and Replication** 3. Replication types and configurations 4. Clustering and failover strategies **Chapter 7: Data Integrity and Auditing** 3. Constraints, transactions, and logging 4. Auditing user activity
Study and examination requirements and forms of examination	Written Mid-Term Exam (40%) + Written Final Exam (60%)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online (Moodle ULT) Video projection

Reading list	1. Oracle Documentation – Oracle Database Administrator's Guide 2. PostgreSQL Docs – https://www.postgresql.org/docs/ 3. Christian Antognini – Troubleshooting Oracle Performance, Apress 4. Grant Fritchey – SQL Server Execution Plans, Red Gate 5. Linux and Shell Basics – for database server maintenance and automation

U5.5 Advanced Databases

NoSQL Databases

Module designation	**Advanced Databases**
Module level, if applicable	Year 3, Semester 1
Code, if applicable	U5.5
Subtitle, if applicable	
Courses, if applicable	**NoSQL Databases**
Semester (s) in which the module is taught	Semester 5
Person responsible for the module	Dept Head
Lecturer	Mr. Houssem Mahmoudi
Language	English
Relation to curriculum	Compulsory module
Type of teaching, contact hours	21 hours Lecture/ semester 21 hours practical workshop in Lab/ semester
Workload	Total 63 hours/semester (21 hours of Self-Study/semester)
Credit points	2
Requirements according to the examination regulations	Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	Big Data
Module objectives/intended learning outcomes	**Learning Outcomes:** Upon completion of this teaching module, the student will be able to: • Define and explain the foundational concepts of NoSQL databases. • Distinguish between various NoSQL database types, including document, key-value, column-family, and graph databases. • Design, model, and implement database solutions using NoSQL technologies. • Analyze the advantages, use-cases, and limitations of NoSQL databases over traditional RDBMS. • Apply consistency, availability, and partition tolerance (CAP theorem) principles in the context of NoSQL databases. • Evaluate security and performance considerations specific to NoSQL databases. • Implement scaling and replication strategies for NoSQL databases

Content	**Chapter 1: Introduction to NoSQL** 1. What is NoSQL? 2. History and evolution of NoSQL 3. Why NoSQL? **Chapter 2: Types of NoSQL Databases** 1. Document databases (e.g., MongoDB) 2. Key-Value stores (e.g., Redis) 3. Column-family stores (e.g., Cassandra) 4. Graph databases (e.g., Neo4j) **Chapter 3: NoSQL Database Design** 1. Data modeling for NoSQL 2. Schema-less design considerations 3. Use case Design task **Chapter 4: CAP Theorem** 1. Consistency 2. Availability 3. Partition tolerance **Chapter 5: Performance and Scaling** 1. Scaling strategies 2. Replication and sharding 3. Advanced case **Chapter 6: Security in NoSQL** 1. Access control 2. Encryption techniques **Chapter 7: Real-world Applications and Integration** 1. Use cases for NoSQL databases 2. Integration in modern web applications
Study and examination requirements and forms of examination	Written Mid-Term Exam (40%) + Written Final Exam (60%)

Media employed	Course Material (Hard/ Soft copy) for Classroom & Online (Moodle ULT) Video projection
Reading list	1. "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence" by Martin Fowler and Pramod Sadalage." 2. Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement" by Luc Perkins, Eric Redmond, and Jim R. Wilson. 3. "NoSQL for Mere Mortals" by Dan Sullivan.

U5.6 Entrepreneurship and Marketing

Entrepreneurship and Innovation

Module designation	**Entrepreneurship and Marketing**
Module level, if applicable	Year 3, Semester 1
Code, if applicable	U5.6
Subtitle, if applicable	
Courses, if applicable	**Entrepreneurship and Innovation**
Semester (s) in which the module is taught	Semester 5
Person responsible for the module	Dept Head
Lecturer	Ms. Neila Mouihbi
Language	French
Relation to curriculum	Compulsory module
Type of teaching, contact hours	21 hours of Supervision on Campus/ semester
Workload	Total 31.5 hours/semester (10.5 hours of Self-Study/semester)
Credit points	1.5
Requirements according to the examination regulations	Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	None
Module objectives/intended learning outcomes	**Course Objective:** The course aims to equip students with the entrepreneurial mindset and tools necessary to identify opportunities, develop innovative solutions, and launch successful ventures. It blends theory and practice to foster creativity, critical thinking, and business model development in dynamic environments. **Learning Outcomes:** By the end of this course, students will be able to: • Recognize and evaluate business opportunities in various sectors • Develop innovative and viable business models • Create and pitch a startup concept with a clear value proposition

Content	**Module 1: Introduction to Entrepreneurship** **Module 2: Opportunity Identification and Market Research** **Module 3: Innovation and Creativity** **Module 4: Business Models and Value Proposition** **Module 5: Building a Startup Strategy** **Module 6: Financial Planning and Funding** **Module 7: Pitching and Communication Skills** **Final Project: Startup Pitch** ***Team-based project: pitch a new venture idea***
Study and examination requirements and forms of examination	Written Mid-Term Exam (40%) + Written Final Exam (60%)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online (Moodle ULT) Video projection
Reading list	1. Eric Ries – The Lean Startup, Crown Business 2. Alexander Osterwalder & Yves Pigneur – Business Model Generation, Wiley 3. Steve Blank – The Startup Owner's Manual, K&S Ranch 4. Guy Kawasaki – The Art of the Start 2.0, Penguin 5. MIT OpenCourseWare – Entrepreneurship and Innovation Series

U5.6 Entrepreneurship and Marketing

Digital Marketing

Module designation	**Entrepreneurship and Marketing**
Module level, if applicable	Year 3, Semester 1
Code, if applicable	U5.6
Subtitle, if applicable	
Courses, if applicable	**Digital Marketing**
Semester (s) in which the module is taught	Semester 5
Person responsible for the module	Dept Head
Lecturer	Ms. Neila Mouihbi
Language	French
Relation to curriculum	Compulsory module
Type of teaching, contact hours	21 hours of Supervision on Campus/ semester
Workload	Total 31.5 hours/semester (10.5 hours of Self-Study/semester)
Credit points	1.5
Requirements according to the examination regulations	Minimum attendance rate: 80% of the total contact hours >20 % of nonattendance = elimination for exams
Recommended prerequisites	None
Module objectives/intended learning outcomes	**Objective:** In this module, student will be introduced to digital marketing. **Learning Outcomes:** Upon completion of this course, students should be able to: • develop and execute a marketing plan • understand the role of digital media in marketing • establish a marketing analytics and quantitative evaluation of the marketing environment.

Content	1. Introduction to Digital Marketing 2. Search Engine Optimisation (SEO) 3. Search Engine Marketing 4. Social Media Marketing 5. Content Marketing & Strategy 6. Web Analytics 7. Google Tag Manager 8. Display Advertising 9. Web Remarketing 10. Email Marketing/ Mobile Marketing 11. E-Commerce / Online Reputation Management 12. Adsense, Blogging, and Affiliate Marketing 13. Analytics and Reporting
Study and examination requirements and forms of examination	Written Mid-Term Exam (40%) + Written Final Exam (60%)
Media employed	Course Material (Hard/ Soft copy) for Classroom & Online (Moodle ULT) Video projection
Reading list	1. Maccoby, M. (2000). Understanding the Difference between Management and Leadership, p. 57. 2. Rosenbach, W. E., Taylor, R. L., & Youndt, M. A. (2012). Contemporary Issues in Leadership, Leadership, Chapter 1, Transcendent Leadership, chapter 4, Summit Leadership, Chapter 5. 3. Walker, R., & Aritz, J. (2014). Leadership Talk: A Discourse Approach to Leader Emergence, Chapter 1.