**Course Code & Title:** **Artificial Intelligence**/ ITCS 509

**Weight:** **(3 - 0 - 3)**

**Prerequisite:** NONE

**NQF Level Allocated:** Level 9

**NQF Notional Hours / Credits:** 120 notional hours/ 12 NQF credit

**Description:** This course focuses on solving real world problems using techniques and methods of Artificial Intelligence (AI) from a computer science perspective and familiarizes students with the present and future of AI. This course is to cover two types of problem solving approaches: search-based and knowledge-based. The course is also to explore advanced AI techniques, such as ANN, EC, and fuzzy logic.

**Objective:**

1. To understand a range of specialized theories, principles and concepts of Artificial Intelligence.
2. To critically explore various intelligent algorithms and techniques for solving complex real world problems.
3. To apply a range of specialist models and knowledge representation methods in developing intelligent systems.
4. To research on new trends in Artificial Intelligence.

SEMESTER:

INSTRUCTOR:

EMAIL:

## Intended Learning Outcomes (ILOs):

| A. Knowledge and Understanding | | NQF Descriptor/ Level |
|---|---|---|
| **A1** | **Concepts and Theories:** Demonstrate knowledge and critical understanding of core concepts and theories in artificial intelligence. | *Knowledge: theoretical understanding [Level 9]* |
| *A2* | **Contemporary Trends, Problems and Research:** Demonstrate critical awareness of the current problems, research issues and methods, technological advancements in field of artificial intelligence. | *Knowledge: theoretical understanding [Level 9]* |
| *A3* | **Professional Responsibility:**                    **N/A** | |
| **B. Subject-specific Skills** | | *NQF Descriptor/ Level* |
| **B1** | **Problem Solving:** Identify and solve complex and real problems using a range of specialized and advanced AI techniques. | *Communication, ICT and Numeracy Skills [Level 9] Generic, Problem Solving and Analytical Skills [Level 9]* |
| **B2** | **Modeling and Design:** Model, and design the components needed to develop intelligent systems to meet desired needs within realistic constraints. | *Knowledge: Practical application [Level 9]* |
| *B3* | **Application of Methods and Tools:** Use and apply advanced techniques and tools to develop efficient and effective artificially intelligent system. | *Knowledge: Practical application [Level 9] Communication, ICT and Numeracy Skills [Level 9]* |
| **C. Critical-Thinking Skills** | | *NQF Descriptor/ Level* |
| **C1** | **Analytic skills:** Critically evaluate the performance of the AI techniques, algorithms and systems in given problems. | *Generic Problem Solving & Analytical skills [Level 9]* |
| *C2* | **Synthetic:** Integrate individual software components to create a larger AI system with more capabilities. | *Generic, Problem Solving and Analytical Skills [Level 9]* |
| *C3* | **Creative Thinking and innovation:**               **N/A** | |
| **D. General and Transferable Skills (other skills relevant to employability and personal development)** | | **NQF Descriptor/ Level** |

| D1 | **Communication:** Convey ideas and describe results rigorously using logic, theoretical models and formal languages, and present these in appropriate written and oral forms. | *Communication, ICT and Numeracy Skills [Level 9]* |
|---|---|---|
| D2 | **Teamwork and Leadership:** Work effectively as a member/leader of a team in order to complete a pre-defined research project. | *Competence: Autonomy, Responsibility and Context [Level 8]* |
| D3 | **Organizational and Developmental Skills:** N/A | |
| D4 | **Ethics and Social Responsibility:** N/A | |

## Course Structure (Outline)

| Course Structure | | | | | | |
|---|---|---|---|---|---|---|
| Week | Hours | | ILOs | Topics | Teaching Method | Assessment Method |
| | Lec. | Lab | | | | |
| 1 | 3 | - | A1 | **Introduction and Intelligent Agents:** AI and Intelligent Agent concepts | Lecture/ Class Discussion | |
| 2-3 | 6 | - | A1, B1, B2 | **Problem Solving:** Problem definition and formulation, Problem Solving Agents. Modelling. | Lecture/ In-Class Exercises | In-Class Exercises |
| 4-5 | 6 | - | A1, A2, B1,B2,C1, D1 | **Search-based Problem solving:** Search Space Graph and Tree, Uniformed search strategies, Informed search strategies, Best first search: Greedy search, optimization problems (Hill climbing search, Simulated annealing search, Genetic algorithms) | Lecture/ In-class Exercises/ Independent Learning | In Class Exercises /Assignment 1 |
| 6 | 3 | - | A1 ,B2, C1 | **Knowledge-Based Problem Solving:** Concepts, Knowledge Representation. | Lecture/ Class Discussion | |
| 7 | 3 | - | A1, B1, C1 | **Knowledge and Reasoning** | Lecture/ In-class Exercises | In-Class Exercises |
| 8 | 3 | - | A1,B1,B2, C2 | **Knowledge Based Systems:** Concepts and Development, Expert Systems. | Lecture/ Class Discussion | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 9 | 3 | - | A1,B1,B2, C1 | **Machine Learning** | Lecture/ Class Discussion | Major Test |
| 10-11 | 6 | - | A1, A2, B1, B2, B3,C1,C2, D1 | **Neural Network:** Concepts, Types of neural network architecture, algorithms. | Lecture/ Independent Learning/ In-class Exercises | In-Class Exercises/ Assignment 2 |
| 12 | 3 | - | A1, A2,B1, B2, B3,C1,C2 | **Natural Language Processing** | Lecture/ Class Discussion/ Independent learning | |
| 13 | 3 | - | A1, A2, B1, C1 | **Evolutionary Computation:** Algorithms and applications | Lecture/ In-class Exercises/ Independent learning | In-Class Exercises |
| 14 | 3 | - | A1, B1,B2 | **Fuzzy Logic** | Lecture/ Class Discussion/ In-class Exercises | In-Class Exercises |
| 15 | 3 | - | A2,B1,B2,B3,C1,C2,D1, D2 | Students projects (reports and presentations) | Student presentations of projects | **Evaluation of Project & Presentation** |
| 16 | 2 | | | | | Final Exam |

**Teaching Materials:**

| | |
|---|---|
| **Textbook(s):** | 1. Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, Prentice Hall, 3rd edition, 2016. <br> 2. Neapolitan, Richard E., and Xia Jiang. *Artificial Intelligence: With an Introduction to Machine Learning*. CRC Press, 2018. |

| Handout(s): | PowerPoint slides available on Moodle i.e. http://www.ahlia.edu.bh/moodle |
|---|---|
| Reference(s): | 1. Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.<br>2. Freedle R. Artificial intelligence and the future of testing. Psychology Press; 2014 Feb 24. 2018<br>3. Kevin P. Murphy, *Machine Learning: A Probabilistic Perspective*, The MIT Press, 2012.<br>4. Charniak, E., Riesbeck, C., McDermott, D., Meehan, J. Artificial Intelligence Programming. New York: Psychology Press. 2nd edition. 2014.<br>5. K.-L. Du and M. N. S. Swamy, *Neural Networks and Statistical Learning*, Springer, 2013.<br>6. Slade, Stephen. Artificial Intelligence Applications on Wall Street. Routledge, 2017.<br>7. C. M. Bishop, *Pattern Recognition and Machine Learning*, Springer, 2011.<br>8. Association for Advancement of Artificial Intelligence (AAAI) Website: http://www.aaai.org/home.html<br>More references are available in the course website in Moodle. |

## Assessment

| Type of Assessment | Description | ILOs | Weighting |
|---|---|---|---|
| Assignments | The purpose of the assignments is to assess students where they have to demonstrate their extensive and detailed knowledge and critical understanding of key concepts, theories, methods, tools and techniques of AI. The assignments will also assess students' skills to solve and analyze AI problems using advanced techniques, methods and tools. Soft copy submission through the course page in Moodle where answers will be checked by Turnitin against plagiarism. | A2, B1, B2, B3, C1, D1 | 20% |
| In- Class Exercises | In-class exercises consist of problem solving and application of different tools. | B1,B2,C1 | Formative Assessment |
| Major Exam | An in-class exam that consists of short-answer, essay, and problem solving questions, and covers the topics studied in the first 8 weeks. | A1,B1, B2, C1 | 20% |

| | | | |
|---|---|---|---|
| Project Report and Presentation | Project teams are required to plan and execute the research project that may involve the application of advanced techniques and tools to develop efficient artificially intelligent system. In the final week, each team will have to submit their reports. The report must explain precisely the work accomplished by each student. Each team will be required to make a presentation summarizing the research conducted and its findings. Each team member has to participate in the presentation. Team-based work will be examined and evaluated as a whole as well as the individual work of each student. Team members will be tested individually during the presentation by peers and the instructor. Soft copy submission through the course page in Moodle where answers will be checked by Turnitin against plagiarism. | A2, B1, B2,B3,C1, C2,D1, D2 | 20% |
| Final Exam | The final exam is comprehensive and will be of two hours duration. It will consist of short-answer, essay and problem-solving questions in AI. | A1, B1, B2, C1, C2 | 40% |
| | | Overall | 100% |

| Admissions | |
|---|---|
| **Pre-requisites** | **NONE** |
| **Minimum number of students** | **4** |
| **Maximum number of students** | **25** |

**Ahlia University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see** www.ahlia.edu.bh/integrity **for more information).**

## COURSE SYLLABUS/ SPECIFICATION

**Course Code & Title: ITCS 511–Advanced Database Systems**

**Weight: (3 - 0 - 3)**

**Prerequisite: None**

**NQF Level Allocated: 9**

**NQF Notional Hours / Credits:** 120 notional hours/ 12 NQF credit

**Description:** This course explores databases as the underlying framework of information system which store, manipulate and retrieve data with particulars emphasis on the relational model and relational systems. Students are expected to design and implement a relational database within the concept of an information system using appropriate analysis and modeling techniques and a modern Database Management System as well as to understand RDBMS, advantages and disadvantages of different query languages and concurrency control and basic query processing.

## Objective:

1. To provide a comprehensive overview of Database concepts, technologies and methodologies.
2. To critically plan, analyze, design, implement, and test database projects.
3. To construct advanced database query using SQL.
4. To critically understand and discuss selected advanced database topics.

**Semester: 2**

**Instructor (s):**

**Office Telephone:**                          **Email (s): ssubramanian@ahlia.edu.bh**

**Intended Learning Outcomes (ILOs):**

| A.  Knowledge and Understanding | NQF Level |
|---|---|
| A1. Concepts and Theories: Demonstrate critical knowledge and understanding of relational database systems and concepts embedded in the storage, manipulation and retrieval of data. | Knowledge: theoretical understanding [Level 9] |
| A2. Contemporary Trends, Problems and Research: Demonstrate critical awareness of the current problems, research issues and methods, technological advancements in the field of database. | Knowledge: theoretical understanding [Level 9] |
| **B.  Subject-Specific Skills** | **NQF Level** |
| B1. Problem Solving: Identify and solve complex problems using a range of specialized skills, techniques related to various database issues. | Communication, ICT and Numeracy Skills [Level 9] Generic, Problem Solving and Analytical Skills [Level 9] |
| B2. Modeling and Design: Develop database models for real-world problems and design their solutions using SQL language. | Communication, ICT and Numeracy Skills [Level 9] Knowledge: Practical application [Level 9] |
| B3. Application of Methods and Tools: Apply specialized methods and advanced tools to design and implement database systems including but not limited to SQL language, distributed database management systems, data mining, and data warehousing. | Knowledge: Practical application [Level 9] Communication, ICT and Numeracy Skills [Level 9] |
| **C.  Critical Thinking Skills** | **NQF Level** |
| C1. Analytic: Critically analyze and evaluate different phases in database design, management and identify scope, objectives and characteristics in addition to identifying requirements for every step. | Generic, Problem Solving and Analytical Skills [Level 9] |
| C2. Synthetic: Develop and integrate components of database systems to deal with complex problems using ER model, schema, and DBMS languages. | Generic, Problem Solving and Analytical Skills [Level 9] |
| C3. Creative: Develop creative ideas to deal with complex problems in the advanced database applications and obtain efficient solutions. | Knowledge: Practical application [Level 9] Generic, Problem Solving and Analytical Skills [Level 9] Communication, ICT and Numeracy Skills [Level 9] |
| **D.  General and Transferable Skills** | **NQF Level** |
| D1. Communication: Express ideas effectively, in written and oral form, to a diverse range of audience using appropriate techniques and tools. | Communication, ICT and Numeracy Skills [Level 9] |

| | D2. Teamwork and Leadership: Work as a productive team member and cooperate with others in order to grasp the skills of a database manager leading a team. | Competence: Autonomy, Responsibility and Context [Level 8] |
|---|---|---|
| | D3. Organizational and Developmental Skills: Demonstrate ability to organize ideas and effectively allocate time in given assignment. | Competence: Autonomy, Responsibility and Context [Level 8] |

## Course Structure (Outline)

| Week | Hours | ILOs | Unit/Module or Topic Title | Teaching Method | Assessment Method |
|---|---|---|---|---|---|
| 1 | 3 | A1 | Introduction and Database Concepts, Database System Concepts and Architecture | Lecture / class discussion | Oral Participation |
| 2 | 3 | A1, B2 | Data Modeling, Entity-Relationship | Lecture | Oral Participation |
| 3 | 3 | A1,B2, C1,C2,D3 | Relational Models, Relational Database Constraints | Lecture | Oral Participation |
| 4 | 3 | A1, B2,B3, C1,C2, D1, D3 | Relational Database Constraints | Lab session & Software demo / supervised group lab work | Assignment 1 / Oral participation |
| 5 | 3 | A1, B2, C1 | Relational Algebra | Lecture / In-class Exercises | In-class Exercises |
| 6 | 3 | A1, B1 | SQL Language, Schema Definition | Lab session & Software demo/ supervised group lab work | In-Lab Exercises |
| 7 | 3 | B1,B3,C1 | SQL Language queries | Lab session & Software demo /Lecture | In-Lab Exercises |
| 8 | 3 | B1,B2,B3 C1,C2 | SQL Language queries | Lab session & Software demo / supervised lab work | Midterm Exam |
| 9, 10 | 6 | A1, B1,B2, B3, C1,C2 | Query Processing | Lecture / In-class Exercises | In-class Exercises/ Assignment 2 |

| | | | | | |
|---|---|---|---|---|---|
| 11 | 3 | A1,B1,B2, C1, C2 | Functional Dependencies and Normalization for Relational Databases | Lecture/ In-class Exercises | Oral Participation / In-class Exercises |
| 12 | 3 | A1, A2,B1 | Distributed database management systems | Lecture/ class discussion | Oral Participation |
| 13 | 3 | A1, A2, C1,B1, B2 | Object-Oriented Database concepts | Lecture/ class discussion | Oral Participation |
| 14 | 3 | A1, A2, B1, B2, C1 | Data Warehouse | Lecture/ class discussion | Oral Participation/ In-class Exercises |
| 15 | 3 | A2, B1, B2,B3, C1, C2, C3, D1, D2, D3 | Students Presentations and reports of Team Research Projects | Presentation of Projects by Students | Evaluation of Project Presentations & Reports |
| 16 | 2 | | | | Final Exam |

**Teaching Materials:**

| | |
|---|---|
| **Textbook(s):** | **Elmasri R. and Navathe S., Fundamentals of Database Systems, 7th Edition, Pearson, 2015** |
| **Handout(s):** | **Instructor's power point slides** |
| **Reference(s):** | **1. Connolly T. and Begg C., Database Systems, A practical Approach to Design, Implementation, and Management, 6th Edition, Pearson, 2014.** **2. Carlos Coronel, Keeley Crockett, Steven Morris, and Peter Rob, Database Principles: Fundamentals of Design, Implementation, and Management, Cengage Learning ,2013.** **3. Avi, Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, 7th Edition , McGraw-Hill, 2010** **4. David M. Kroenke, David J. Auer, Scott L. Vandenberg, and Robert C. Yoder, Database Concepts, 8th, Pearson, 2017.** **5. Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom, Database Systems: The Complete Book, 2ed, Prentice Hall, 2009** |

| | 6. More references are available in the course website in Moodle. |
|---|---|

**ASSESSMENT:**

| Type of Assessment | Description | ILOs | Weighting |
|---|---|---|---|
| Research Assignments | The assignments consist of essay, problem-solving and research based theoretical questions regarding topics in advanced database systems covered during the course. The purpose of the assignment is to assess students where they must demonstrate their extensive and detailed knowledge and critical understanding of database systems. | A2, B1, B2, C1, D1,D3 | 20% |
| Oral Participation | Students will be questioned orally to demonstrate their understanding and knowledge of the topics covered during class lectures and lab sessions. | A1, D1 | 3% |
| Midterm Exam | The midterm exam will be an in-class 1-hour exam that will consists of short-answer, essay, and problem solving questions and cover the topics studied in the first 8 weeks. Students will be asked to design and model some components of database. | A1,B1,B2,B3,C1,C2 | 20% |
| Team Project Report and Presentation | The class will be divided into teams of 2-5 students where each team will be asked to study a problem in advanced database systems utilizing the skills and tools learned in class. Teams are required to plan and execute the project that may involve the development and implementation of database models for real-world problems and their solutions, the application of Data Warehousing and OLAP techniques and/or the development and integrations of database systems components using ER model, schema, and DBMS languages. In the final week, each team will have to submit their research report explaining the research problem, research methods used, analysis and the conclusion highlighting the research findings and results. The report must explain precisely the work accomplished by each student. Each team will be required to make a presentation summarizing the research conducted and its findings. Each team member has to participate in the presentation. Team-based work will be examined and evaluated as a whole as well as the individual work of each | A2, B1, B2,B3, C1, C2, C3, D1, D2, D3 | 17% |

| | | | |
|---|---|---|---|
| | student. Team members will be tested individually during the presentation by peers and the instructor. | | |
| Final Exam | The final exam is comprehensive and will be of two hours duration. It will consist of short-answer, essay and problem-solving questions including questions to develop parts of database systems to solve real-life problems. | A1, B1, B2,B3, C1, C2, C3 | 40% |
| | | Overall | 100% |

| Admissions | |
|---|---|
| Pre-requisites | None |
| Minimum number of students | 4 |
| Maximum number of students | 20 |

**COLLEGE OF INFORMATION TECHNOLOGY**

**DEPARTMENT OF IT**

**COURSE SYLLABUS/ SPECIFICATION**

| | |
|---|---|
| **Course Code & Title:** | **ITCS 514- Object Oriented Software Engineering** |
| **Weight:** | **(3-0-3)** |
| **Prerequisite:** | **None** |
| **NQF Level Allocated:** | **9** |
| **NQF Notional Hours / Credits:** | **120 notional hours/ 12 NQF credit** |

**Description:** This course focuses on object-oriented approach necessary to solve advanced and complex real-world problems. It is to understand a range of specialized theories, principles and concepts of object-orientation; object oriented software development process; the use of object-oriented design tools such as UML for modeling problem solutions. Topics include: Problem analysis and specification of software requirements; object-oriented design; reusability and design patterns; unit testing; advanced software development methodology such as Adaptive Object-Oriented Software Development.

**Objective:**

1. To critically explore various software development approaches and models.
2. To understand a range of specialized theories, principles and concepts of object-orientation, and their advantages.
3. To explain the development process of object oriented software.
4. To apply a range of specialist models and methods in developing software systems.
5. To research current trends in object oriented methodology and software engineering.

**Semester:**

**Instructor (s):**

**Office Telephone:     EXT:                         Email (s):**


**Intended Learning Outcomes (ILOs):**

| A.  Knowledge and Understanding | | NQF Descriptor/ Level |
|---|---|---|
| A1 | **Concepts and Theories:** Demonstrate critical understanding of a range of specialized theories, principles and concepts of software engineering and object oriented methodology. | Knowledge: theoretical understanding [Level 9] |
| A2 | **Contemporary Trends, Problems and Research:** Demonstrate critical awareness of the current research, trends and advancements in software engineering and object oriented methodology. | Knowledge: theoretical understanding [Level 9] |


| B.  Subject-specific Skills | | NQF Descriptor/ Level |
|---|---|---|
| B1 | **Problem Solving:** Use a variety of advanced approaches to identify problems, elicit, analyze, formulate and specify requirements of stakeholders, design and model solutions. | Knowledge: Practical Application [Level 9] Skills: Communication, ICT & Numeracy [Level 9] |
| B2 | **Modeling and Design:** Apply a range of specialist models to model different perspectives of software using UML, and to apply different approaches to design software architecture and components. | Knowledge: Practical Application [Level 9] |
| B3 | **Application of Methods and Tools:** Apply appropriate advanced methods and tools to software development process. | Skills: Communication, ICT & Numeracy [Level 9] |

| C. Critical-Thinking Skills | | NQF Descriptor/ Level |
|---|---|---|
| C1 | **Analytic skills:** Conduct critical analysis of complex real world problems in order to identify possible solutions. | Generic Problem Solving & Analytical skills [Level 9] |
| C2 | **Synthetic:** Critically review, and extend knowledge/skills/practices in software development to construct and reuse the multiple components of software/system. | Generic Problem Solving & Analytical skills [Level 9] |
| C3 | **Creative:** Demonstrate creativity both in the application of knowledge and in the development of effective and efficient software applications to real world problems. | Generic Problem Solving & Analytical skills [Level 9] |

| D. General and Transferable Skills (other skills relevant to employability and personal development) | | NQF Descriptor/ Level |
|---|---|---|
| D1 | **Communication:** Develop an ability to effectively communicate with peers, and senior colleagues. Honing presentations skills in project report writing and oral presentation. | Communication, ICT and Numeracy Skills [Level 9] |
| D2 | **Teamwork and Leadership:** Work effectively as a member of a study group, and where appropriate lead or take the initiative, to complete the group project/assignments according to deadlines. | Competence: Autonomy, Responsibility and Context [Level 9] |
| D3 | **Organizational and Developmental Skills:** Learn to manage learning tasks independently and professionally with a view to inculcating skills for self-development and life-long learning in order to effectively prioritize, plan, manage and allocate appropriate resources to implement tasks in projects. | Competence: Autonomy, Responsibility and Context [Level 9] |

## Course Structure (Outline)

| Week | Hours | | ILOs | Topics | Teaching Method | Assessment Method |
|------|-------|-----|------|--------|-----------------|-------------------|
| | Lec. | Lab | | | | |
| 1 | 3 | - | A1 | Course overview, software development process, software development approaches | Lecture/ Class Discussion | Major Exam (9th week) and Final Exam (Last Week) |
| 2 | 3 | - | A1 | Principles of object orientation and its advantages, differences between an object-oriented approach and a procedural approach | Lecture/ Class Discussion | Major Exam (9th week) and Final Exam (Last Week) |
| 3 | 3 | - | A1, <br><br> A2, D1, D3 | Process models | Lecture/ <br><br><br> Independent Learning | Major Exam (9th week) and Final Exam (Last Week)/ **Assignment1 (literature reviews)** |
| 4 | 3 | - | A1 | Modeling Concepts, Introduction to UML | Lecture/ Class Discussion | Major Exam (9th week) and Final Exam (Last Week) |
| 5 | 3 | - | B1, C1 | Object oriented software requirement analysis | Lecture/ In class exercises/ Case Studies | Project (week 15)/ Major Exam (9th week) and Final Exam (Last Week) |
| 6 | 3 | - | B1, B2, B3 | Requirement specification and Use Case model | Lecture/ In class exercises/ Case Studies | **Exercises**/ Project (week 15)/ Major Exam (9th week) and Final Exam (Last Week) |
| 7 | 3 | - | B2, C1, C2 | Software Architecture design | Lecture/ Case Studies | Major Exam (9th week) and Final Exam (Last Week)/ Project (week 15) |
| 8-9 | 3 | - | B2, C1, C2 | Object oriented software design | Lecture/ Class Discussion | Project(week 15)/ **Major Exam** (9th week) and Final Exam |

| | | | | | | (Last Week) |
|---|---|---|---|---|---|---|
| 10-11 | 9 | - | B2, B3, C2 | Static and dynamic design modeling | Lecture/ Case Studies/ In class exercises | **Exercises**/ Project (week 15)/ Major Exam (9th week) and Final Exam (Last Week) |
| 12 | 3 | - | A2, C2, B2, B3, D1, D3 | Reusability and design patterns | Lecture/ Independent Learning | **Exercises**/Project (week 15)/ Final Exam (Last Week) |
| 13 | 3 | - | B3 | Unit testing | Lecture/ tools demonstration | Project (week 15)/ Final Exam (Last Week) |
| 14 | 3 | - | A2, B2, D1, D3 | Aspect-Oriented Software Development | Lecture/ Independent Learning | **Assignment2**/ Final Exam (Last Week) |
| 15 | 3 | - | A2, B1,B2, B3, C1, C2, C3, D1, D2, D3 | Student Team Project Presentations | Regulations and Procedures for the project | **Student Project Presentation (**A2, B1,B2, B3, C1, C2, C3, D1, D2, D3**)** |
| 16 | 2 | | | | | **Final Exam (**A1,A2, B1,B2,B3, C1,C2) |

* Formative assessment

**Teaching Materials:**

| | |
|---|---|
| **Textbook(s):** | 1. Alan Dennis, Barbara Haley Wixom, David Tegarden, systems analysis and design: an object oriented approach with uml, 5th Edition,  John Wiley & Sons, 2016. ISBN: 1-118-80467-8, 978-1-118-80467-4, 1-119-03026-9, 9781119030263.<br>2. Additional: Bernd Bruegge, Allen H.Dutoit, object-oriented software engineering using UML, Patterns, and Java ,3rd edition,Pearson,2014 |
| **Handout(s):** | Lecture Notes and Case Studies |
| **Reference(s):** | 1. Ian Sommer Sommerville. *Software Engineering*,  9th Edition,  Addison Wesley, 2010.<br>2. Simon Bennett, Steve McRobb and Ray Framer, *Object-Oriented System Analysis and Design using UML*, 4th Edition, McGraw Hill, 2011.<br>3. Kim Waldén and Jean-Marc Nerson, *Seamless Object-Oriented Software Architecture: Analysis and Design of Reliable Systems*, 4th Edition, 2012.<br>4. Roger S Pressman. *Software Engineering – A Practitioners Approach*, McGraw Hill, 2006.<br>Journal papers will be available in the course website. |

## Assessment

| Method of Assessment | Description | Learning Outcomes | Weighting |
|---|---|---|---|
| **Major Exam** | The major exam will be an in-class 90 minutes exam that will consists of short-answer, essay, and problem solving questions, and cover the topics studied in the first 9 weeks. | A1,A2,B1,B2, B3,C1,C2 | 20% |
| **Two Assignments** | The assignments consist of essay, problem-solving and literature review. The purpose of the assignments is to assess students where they have to demonstrate their extensive and detailed knowledge and critical awareness of current research, trends and advancements in software engineering and object-oriented software development methodology. The assignments will also assess students' skills in applying problem solving approaches to elicit and analyze requirements of stakeholders, design and model solutions. Soft copy submission is required through the course page in Moodle where answers will be checked by Turnitin against plagiarism. | A2, C2, B2, B3, D1, D3 | (10% + 10% =) 20% |
| **Exercises** | In-class exercises consist of problem solving and application of different tools and models to model and design software components. Each exercise will be one hour duration. | B1,B2, B3 | Formative Assessment |
| **Team Project** | Student teams will propose and develop a medium-sized project of their own. Soft copy submission is required through the course page in Moodle where the project report will be checked by Turnitin against plagiarism. | A2, B1,B2, B3, C1, C2, C3, D1, D2, D3 | 20% Method of Evaluation: Completeness(8 marks) Quality(3 marks) Creativity(2 marks) Presentation: report quality, and oral presentation (flow of information, student personality, understanding and |

| | | | Q/A) (5 marks) Team Work (team embers meeting minutes) (2 marks) |
|---|---|---|---|
| **Final Exam** | The final exam is comprehensive and will be of two hours duration. It will consist of short-answer, essay and problem-solving questions. | A1,A2,B1,B2, B3,C1,C2 | 40% |
| **Overall:** | | | **100 %** |


| Admissions | |
|---|---|
| **Pre-requisites** | **None** |
| **Minimum number of students** | **4** |
| **Maximum number of students** | **25** |


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# COLLEGE OF INFORMATION TECHNOLOGY

# DEPARTMENT OF INFORMATION TECHNOLOGY

## COURSE SYLLABUS/ SPECIFICATION

**Course Code & Title:**    **ITCS 515 – Business Intelligence**

**Weight:**    **(3 - 0 - 3)**

**Prerequisite:**    NONE

**NQF Level Allocated:**    Level 9

**NQF Notional Hours / Credits:** 120 notional hours/ 12 NQF credit

**Description:** Business intelligence (BI) refers to the science of using advanced analysis and reporting tools to discover the necessary information used by an organization to make sound decisions. In this course, students will learn how to maximize business advantage by locating, extracting and dispersing information. Moreover, students will be introduced to some BI software and tools such as Microsoft BI. The covered topics include business intelligence framework, infrastructure, and current techniques used to extract, transform, and analyze  business data, and to discover knowledge to support business decision-making

## Objective:

1.  To understand a range of specialized theories, principles and concepts of BI.
2. To explain how to maximize business advantage by locating, extracting and dispersing information.
3. To explain the importance of BI in large and medium-sized corporations.
4. To critically explore various and advanced techniques, tools and good practices in BI.
5. To research current trends of BI practices and applications in industry.


SEMESTER:                                     ACADEMIC YEAR:

INSTRUCTOR:
OFFICE TEL:

## Intended Learning Outcomes (ILOs):

| A. Knowledge and Understanding | | NQF Descriptor/ Level |
|---|---|---|
| A1 | **Concepts and Theories:** Demonstrate critical knowledge and understanding of key concepts and theories of BI, data warehousing and data mining. | Knowledge: theoretical understanding [Level 9] |
| *A2* | **Contemporary Trends, Problems and Research:** Demonstrate an informed and critical awareness of the current research, trends and advancements in decision-support systems and BI applications, integration, technologies and tools. | Knowledge: theoretical understanding [Level 9] |
| *A3* | *Professional Responsibility:* Demonstrate cognizance of and adhere to the IT-related roles and responsibilities of professionals working in BI environments. | Knowledge: theoretical understanding [Level 9] |

| B. Subject-specific Skills | | NQF Descriptor/ Level |
|---|---|---|
| B1 | **Problem Solving:** Critically analyze and identify business problems, and develop BI solutions for them to inform decision making. | Communication, ICT and Numeracy Skills [Level 9]  Knowledge: practical application [Level 9] |
| B2 | **Modeling and Design:** Develop a multidimensional data models and design BI systems to facilitate decision making. | Knowledge: practical application [Level 9] |
| *B3* | *Application of Methods and Tools:* Apply data mining techniques, OLAP, and BI software to generate business intelligence. | Communication, ICT and Numeracy Skills [Level 9] |

| | Knowledge: practical application [Level 9] |
|---|---|

| C. Critical-Thinking Skills | | NQF Descriptor/ Level |
|---|---|---|
| C1 | **Analytic skills:** Evaluate the complexity of challenging business processes and critically analyze its decision support systems, structured and unstructured data, resources, roles, risks, and performances to generate useful information and knowledge that lead to effective and efficient enhancement of the business processes. | Generic problem solving and analytical skills [Level 9] |
| *C2* | **Synthetic:** Integrate individual software components with other components such as a Neural Network classifier in order to create a larger AI system with more capabilities. | Generic problem solving and analytical skills [Level 9] |
| *C3* | **Creative:** Identify new business problems, processes or decision-support systems that can be solved or improved efficiently using advanced BI methods, techniques and tools in a way that supports insight and improve decision making. | Generic problem solving and analytical skills [Level 9] Competence: Autonomy, Responsibility and Context [Level 9] |

| D. General and Transferable Skills (other skills relevant to employability and personal development) | | NQF Descriptor/ Level |
|---|---|---|
| D1 | **Communication:** Develop an ability to effectively communicate with peers, and senior colleagues. Honing presentations skills in project report writing and oral presentation. | Communication, ICT and Numeracy Skills [Level 9] |
| *D2* | *Teamwork and Leadership:* Work as a member/leader of a team project for developing a BI solution for business problem. | Competence: Autonomy, Responsibility and Context |

| | | [Level 9] |
|---|---|---|
| D3 | *Organizational and Developmental Skills:* Engage in life-long learning and continuing self-development to enhance and practice professional and organizational skills in order to effectively prioritize, plan, manage and allocate appropriate time to implement tasks in BI projects and assignments. | Competence: Autonomy, Responsibility and Context [Level 9] |
| D4 | *Ethics and Social Responsibility:* Understand and adhere to the ethical values and responsibilities involved in, e.g., the analysis of business data and information. | Competence: Autonomy, Responsibility and Context [Level 8] |

## Course Structure (Outline)

<table>
<tr><th colspan="7">Course Structure (Outline)</th></tr>
<tr><th rowspan="2">Week</th><th colspan="2">Hours</th><th rowspan="2">ILOs</th><th rowspan="2">Topics</th><th rowspan="2">Teaching Method</th><th rowspan="2">Assessment Method</th></tr>
<tr><th>Lec.</th><th>Lab</th></tr>
<tr><td>1</td><td>3</td><td>-</td><td>A1</td><td>**Introduction to BI**</td><td>Lecture/ Class discussion</td><td>Major Exam (9th week) and Final Exam (Last Week)</td></tr>
<tr><td>2</td><td>3</td><td>-</td><td>A1</td><td>**Business Intelligence**: Concepts, components, framework and importance of BI</td><td>Lecture/ Class discussion</td><td>Major Exam (9th week) and Final Exam (Last Week)</td></tr>
<tr><td>3, 4</td><td>3</td><td>-</td><td>A1,A2, D1, D3, D4</td><td>**Business Intelligence:** how BI supports decision process, and Decision Support Systems</td><td>Lecture/ case studies/ Independent learning</td><td>Major Exam (9th week) and Final Exam (Last Week)/ **Research Assignment1**</td></tr>
<tr><td>5</td><td>3</td><td>-</td><td>A1,A2, C2, D1, D3, D4</td><td>**Data Warehouses, and Data Marts**</td><td>Lecture/ Class discussion/ Independent learning</td><td>Project (week 15)/ Major Exam (9th week) and Final Exam (Last Week)/ **Research Assignment 2**</td></tr>
</table>

| | | | | | | |
|---|---|---|---|---|---|---|
| 6 | 3 | - | C2 | **ETL:** Data Extracting, Transformation, and Loading; | Lecture/ Class discussion | Project (week 15)/ Major Exam (9th week) and Final Exam (Last Week) |
| 7 | 3 | - | A1,B2, C1 | **OLAP:** Online Analytical Processing, applications, multidimensional data, functionality and architecture | Lecture/ Exercises/ Class discussion | **Exercises**/Major Exam (9th week) and Final Exam (Last Week)/ Project (week 15) |
| 8 | 3 | - | B3 | **BI Tools** | **Software Demonstration** | Project(week 15) |
| 9-11 | 9 | - | A1, B1,B2,C1,C2 | **Data Mining**: Data mining concepts, process, data mining techniques | Lecture/ Class discussion/ Exercises | **Exercises**/ Project (week 15)/ **Major Exam** (9th week) and Final Exam (Last Week) |
| 12 | 3 | - | A2, B1,B2,C1,C2, D1, D3, D4 | **Data Mining**: Intelligent Techniques, such as genetic algorithm and neural networks | Lecture / Exercises/ Independent learning | **Exercises**/Project (week 15)/ **Research Assignment3**/ Final Exam (Last Week) |
| 13 | 3 | - | B3 | **Data Mining Tools** | **Software Demonstration** | Project (week 15) |
| 14 | 3 | - | A3, B1,B2, C1,C2 | **BI Project Planning** | Lecture/ Class discussion | Project (week 15)/Final Exam (Last Week) |
| 15 | 3 | - | A2, A3, B1,B2,B3, C1,C2,C3,D1,D2,D3, D4 | BI team research project presentations | Student research project presentations/ discussion | **Evaluation of Research Project Reports and Presentations** |
| 16 | 2 | | | | | **Final Exam (**A1, A2,A3,B1, B2, C1, C2) |

# Teaching Materials:

| Textbook(s): | Ramesh Sharda, Dursun Delen, Efraim Turban, David King, Business Intelligence: A Managerial Approach, Global Edition, 4th Edition, 2018, Pearson, ISBN: 9781292220581<br><br>C. Howson, *Successful Business Intelligence: Unlock the Value of BI & Big Data*, 2nd Ed., McGraw-Hill Osborne Media, 2013. |
|---|---|
| Handout(s): | PowerPoint slides available on Moodle i.e. http://www.ahlia.edu.bh/moodle |
| Reference(s): | 1. Rick Sherman, *Business Intelligence Guidebook: From Data Integration to Analytics,* 1st Edition, 2014.<br>2. Jiawei Han, Micheline Kamber, Jian Pei Simon, *Data Mining - Concepts and Techniques,* 3rd Edition, Elsevier, 3rd Edition, 2011.<br>3. Rajiv Sabherwal and I. Becerra-Fernandez, *Business Intelligence,* Wiley, 2011.<br>4. Turban, R. Sharda, D. Delen, D. King, *Business Intelligence: A Managerial Approach,* Pearson, 2013.<br>5. R. Kimball and M. Ross, *The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modeling*, 3rd Ed., Wiley, 2013.<br>6. Ramesh Sharda, Dursun Delen, Efraim Turban, *Analytics, Data Science, & Artificial Intelligence: Systems for Decision Support*, 11th Edition, 2019.<br>7. L. Torgo, *Data Mining with R: Learning with Case Studies*, Chapman and Hall/CRC, 2010.<br>8. M. Hofmann and R. Klinkenberg, *RapidMiner: Data Mining Use Cases and Business Analytics Application,* Chapman and Hall/CRC, *2013.*<br>9. More references are available in the course website in Moodle. |

**ASSESSMENT:**

| Type of Assessment | Description | ILOs | Weighting |
|---|---|---|---|
| Assignments | The assignments consist of essay, problem-solving and research based theoretical questions regarding topics in business intelligence (BI). The purpose of the assignments is to assess students where they have to demonstrate their extensive and detailed knowledge and critical understanding of key concepts, theories, methods, tools and techniques of BI. The assignment will also assess students' skills to identify and formalize business processes and develop BI solutions for them to inform decision making. Soft copy submission is required through the course page in Moodle where answers will be checked by Turnitin against plagiarism. | A1, A2, B1, B2, C1, C2, D3, D4 | 20% |
| Exercises | In-class exercises consist of problem solving and application of | B1, B2, | Formative |

| | | | |
|---|---|---|---|
| | different methods, algorithms, and data models. Each exercise will be one hour duration. | C1 | |
| Major Exam | The major exam will be an in-class 90 minutes exam that will consists of short-answer, essay, and problem solving questions and cover the topics studied in the first 7 weeks. | A1, A2, B1, B2, C1,C2 | 20% |
| Team Research Project Report and Presentation | Starting from weak 4, the class will be divided into teams of 4-5 students and each will be asked to study a research problem in BI utilizing the skills and tools learned in class. Teams are required to plan and execute the research project that may involve the application of advanced techniques, skills and tools in BI and decision-support systems to develop solutions for business-related problems. In the final week, each team will have to submit their research report explaining the research problem, research methods used, analysis and the conclusion highlighting the research findings and results. The report must explain precisely the work accomplished by each student. Each team will be required to make a presentation summarizing the research conducted and its findings. Each team member has to participate in the presentation. Team-based work will be examined and evaluated as a whole as well as the individual work of each student. Team members will be tested individually during the presentation by peers and the instructor. | A2, B1,B2,B3, C1, C2,C3, D1,D2, D3,D4 | 20% |
| Final Exam | The final exam is comprehensive and will be of two hours duration. It will consist of short-answer, essay and problem-solving questions in data analytics. | A1, A2, A3,B1,B2, C1, C2 | 40% |
| | | Overall | 100% |

| Admissions | |
|---|---|
| Pre-requisites | NONE |
| Minimum number of students | 4 |
| Maximum number of students | 25 |

**Ahlia University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see** www.ahlia.edu.bh/integrity **for more information).**

# COLLEGE OF INFORMATION TECHNOLOGY

# DEPARTMENT OF INFORMATION TECHNOLOGY

## COURSE SYLLABUS/ SPECIFICATION

| | |
|---|---|
| **Course Code & Title:** | **ITCS 518 – Mobile Application Development** |
| **Weight:** | **(3-0-3)** |
| **Prerequisite:** | **None** |
| **NQF Level Allocated:** | **9** |

**NQF Notional Hours / Credits:**   **120 notional hours/ 12 NQF credit**

**Description:** The course discusses the principles of design and development for mobile device applications. Students will learn how to develop, simulate, and test Android applications. The topics covered include Android platform; mobile hardware; cell networks; mobile architectures, operating systems, languages, development environments and simulators, and user interfaces; location-based services; data storage and retrieval.

## Objective:

1. To explain how to design, develop, test and deploy Android mobile applications using modern mobile development tools.
2. To study the application of layout management and multi-layout techniques to create adaptable user interfaces for mobile applications that share a common data model.
3. To discuss the management of user data and multimedia on a mobile device via the Android framework libraries.
4. To explain how sensors available on mobile devices enhance user interaction and feedback

**Semester:**

**Instructor (s):**

**Office Telephone:**                              **Email (s):**

**Intended Learning Outcomes (ILOs):**

| A. Knowledge and Understanding | | NQF Descriptor/ Level |
|---|---|---|
| A1 | **Concepts and Theories:** Demonstrate knowledge and understanding of key concepts and techniques of programming environments to design, code, test and deploy mobile applications | Knowledge: theoretical understanding [Level 9] |
| A2 | **Contemporary Trends, Problems and Research:** Recognize the current computing issues and research on emerging mobile computing technologies. | Knowledge: theoretical understanding [Level 9] |
| A3 | **Professional Responsibility:** Demonstrate an awareness of professional ethics and responsibilities related to Mobile application development through case studies dealing with real life examples | Knowledge: theoretical understanding [Level 9] |

| B. Subject-specific Skills | | NQF Descriptor/ Level |
|---|---|---|
| B1 | **Problem Solving:** Design, code, test and deploy efficiently mobile applications having in mind the different designs, techniques of coding and deployment of mobile applications discovered through research. | Skills: Communication, ICT and Numeracy Skills [Level 9] Knowledge: Practical Understanding [Level 9] |
| B2 | **Modeling and Design:** Design the architecture of mobile applications which comprises the user interface and its components and the main functionalities of the mobile application by having in mind the different designs of mobile applications discovered through research. | Skills: Communication, ICT and Numeracy Skills [Level 9] Knowledge: Practical Understanding [Level 9] |
| B3 | **Application of Methods and Tools:** Use and apply appropriate development tools such as Android Studio to develop and manipulate mobile applications. | Skills: Communication, ICT and Numeracy Skills [Level 9] Knowledge: Practical Understanding |

| | | [Level 9] Competence: Context [Level 8] |
| --- | --- | --- |

| C. Critical-Thinking Skills | | NQF Descriptor/ Level |
| --- | --- | --- |
| C1 | **Analytic skills:** Critically evaluate and test the results of output of the developed mobile applications. | Generic cognitive skills [Level 9] |
| C2 | **Synthetic:** Construct and reuse the multiple components of software/system for developing the mobile applications. | Generic cognitive skills [Level 9] |
| C3 | **Creative Thinking and innovation:** Create efficient Modern User Interfaces for the mobile applications. | Generic cognitive skills [Level 9] |

| D. General and Transferable Skills (other skills relevant to employability and personal development) | | NQF Descriptor/ Level |
| --- | --- | --- |
| D1 | **Communication:** Express and communicate ideas effectively, in written and oral form to their colleagues and/or Instructor, as appropriate. | Communication, ICT and Numeracy Skills [Level 9] |
| D2 | **Teamwork and Leadership:** Work effectively as a member/leader of a team of technical people who may plan, design, implement, manage, monitor a project | Competence: Autonomy & Responsibility [Level 9] Competence: Learning to learn [Level 9] |
| D3 | **Organizational and Developmental Skills:** Engage in life-long learning and continuing self-development to hone professional and organizational skills. Assimilate effective work habits including but not limited to time management | Competence: Learning to learn [Level 9] |
| D4 | **Ethics and Social Responsibility:** Recognize, accept, and follow ethical and social responsibility and respond positively to the needs of society by identifying, employing and utilizing effectively the advanced computing and information solutions and technologies | Competence-Insight [Level 8] |

## Course Structure (Outline)

| Course Structure (Outline) |
| --- |

| Week | Hours | | ILOs | Topics | Teaching Method | Assessment Method |
|---|---|---|---|---|---|---|
| | Lec. | Lab | | | | |
| 1 | 3 | - | A1, D4 | Android Introduction | Lecture/ Lab session demo | - |
| 2 | 3 | - | A1, D4 | Android Development Tools | Lecture | Class Participation (A1) |
| 3 | 3 | - | A1, B2, B3, C2, D1 | Android First Application | Lecture/ Lab session demo, Exercises | Class Participation (A1,D1) |
| 4 | 3 | - | A1, B2, B3, C2, C3, D1 | Android Structure of the Application | Lecture/ Lab session demo | Class Participation (A1,D1) |
| 5 | 3 | - | A1, B1, B3, C1, C2, D1, D3 | Android UI Part 1: TextView, ImageView, ScrollView | Exercises | Class Participation (A1,D1)/ **Programming Project 1 (A1, B1, B3, C1, C2, D1, D3)** |
| 6 | 3 | - | A1, B2, B3, C1, C2 | Android Activity | Lecture/ Lab session demo, Exercises | Class Participation (A1) |
| 7 | 3 | - | A1, B1, B2, B3, C1, C2, D1 | Android UI Part 2: MediaPlayer, Button, Start a new Activity | Lecture | Class Participation (A1,D1)/ **Midterm Exam (A1, B1, B2, B3, C1, C2)** |
| 8 | 3 | - | A1, B1, C1, D1 | Exporting Android App | Lecture, Exercises | Class Participation (A1,D1) |
| 9 | 3 | - | A1, B3, C1, C2, D1 | Debugging Android App | Lecture/ Lab session demo, Exercises | Class Participation (A1,D1) |
| 10 | 3 | - | A1, B1, B2, B3, C1, C2, C3, D3 | Android UI Part 3: EditText, RadioGroup, | Lecture/ Lab session demo, Exercises | Class Participation (A1) / |

| | | | | RadioButton | | **Programming Project 2 (A1, B1, B2, B3, C1, C2, C3, D3 )** |
|---|---|---|---|---|---|---|
| 11 | 3 | - | A1, A2, A3,B1, B2, C1, C3 | Android UI Part 4: EditText, TextView, Button Form Validation | Lecture, Exercises | Class Participation (A1) |
| 12 | 3 | - | A1, A2, A3,B1, B2, C1, C3 | Android UI Part 5: ListView. | Lecture/ Lab session demo, Exercises | Class Participation (A1) |
| 13 | 3 | - | A1, A2, A3, B1, C1, C2, C3, D3, D4 | Android UI Part 6: Action Bar. | Lecture, Exercises | Class Participation (A1)/ **Research Assignment (A1, A2, A3, B1, C1, C2, C3, D3, D4)** |
| 14 | 3 | - | A1, A2, A3, B1, C3, D4 | Android UI Part 7: WebView. & Android Database SQLite | Lecture, Exercises | Class Participation (A1,D4) |
| 15 | 3 | - | A1, A2, A3, B1, B2, B3, C1, C2, C3, D1, D2, D3,D4 | Putting It All Together, Student presentations and reports of team research projects | Lecture, student presentations | Class Participation (A1,D1)/ Evaluation of **Team Project Presentations & Reports (A1, A2, A3, B1, B2, B3, C1, C2, C3, D1, D2, D3,D4)** |

\* Formative assessment


## Teaching Materials:

| | |
|---|---|
| **Textbook(s):** | Reto Meier and Ian Lake, *Professional Android (4th edition),* Wrox, 2018, ISBN: 978-1118949528 |
| **Handout(s):** | Power point slides, http://www.ahlia.edu.bh/moodle. |
| **Reference(s):** | 1. Teg Hagos, *Learn Android Studio 3*, Apress, 2018, ISBN: 978-1484231555<br>2. Mark Wickham, *Practical Android: 14 Complete Projects on Advanced Techniques and Approached*, Apress, 2018, ISBN: 978-1484233320<br>3. Neil Smyth, *Android Studio 3.0 Development Essentials – Android 8 Edition,* CreateSpace Independent Publishing Platform, 2017, ISBN: 978-1977540096<br>4. B. Phillips and B. Hardy, Android Programming: The Big Nerd Ranch Guide, Big Nerd Ranch Guides, 2013.<br>5. I. G. Clifton, *Android User Interface Design: Turning Ideas and Sketches into Beautifully Designed Apps*, Addison-Wesley Professional, 2013.<br>6. Google Android Studio, https://developer.android.com/studio/<br>7. Google, Android Developer Resources, https://developer.android.com/index.html |


## Assessment

| Method of Assessment | Description | Learning Outcomes | Weighting |
|---|---|---|---|
| Research Assignment | The assignment consists of essay, problem-solving and research based theoretical questions including topics covered in weeks 13 and 14. The purpose of the assignment is to assess students individually where they have to demonstrate their extensive and detailed knowledge and critical awareness of current research, trends and advancements in mobile applications. The assignment will also assess students' skills in designing, coding, testing and deploying efficient and interactive mobile applications having in mind the different designs, techniques of coding and deployment of mobile | A1, A2, B1, C1, C2, C3, D3, D4 | 10% |

| | applications discovered through research. Soft copy submission is required by the end of the 10th week through the course page in Moodle where answers will be checked by Turnitin against plagiarism. Any implementation code developed during this assignment will have to be submitted also electronically to be tested and evaluated. | | |
|---|---|---|---|
| Programming Project 1 | Students will be asked (individually) to use and apply appropriate development tools such as Android Studio to develop and manipulate specific mobile applications. The output of the programming project should be submitted electronically by the end of week 6 to be tested and evaluated. Student programs will be evaluated in lab sessions where students have to justify their choices of the design and architecture of the developed applications. | A1, B1, B3, C1, C2, D1, D3 | 8% |
| Programming Project 2 | Same as Project 1 where students has to code, test and deploy interactive mobile applications with more emphasizes on the use of creative efficient Modern User Interfaces, communication, telephony, graphics and multimedia components. Students will be assessed also on their skills to construct and reuse multiple components of the mobile application. The output of the programming project should be submitted electronically by the end of week 11 to be tested and evaluated. Student programs will be evaluated in lab sessions where students have to justify their choices of the design and architecture of the developed applications. | A1, B1, B2, B3, C1, C2, C3, D3 | 8% |
| Class Participation | Students will be questioned orally to demonstrate their understanding and knowledge of the topics covered during class lectures and lab sessions. Feedback will be given to students to reaffirm their learning outcomes. | A1, D1, D4 | Formative |
| Midterm Exam | The midterm exam will be an in-class 1-hour exam that will consists of short-answer, essay, and problem solving questions and cover the topics studied in the first 7 weeks. Students will be asked to design and write the code of some components of mobile applications. | A1, B1, B2, B3, C1, C2 | 18% |
| Team Research Project (Report and Presentation ) | Starting from weak 4, the class will be divided into teams of 4-5 students where each team will be asked to study a research problem in mobile application development utilizing the knowledge, skills and tools learned in class. Teams are required to plan and execute the research project that must involve a main component of designing, coding, testing and deploying efficient and interactive multimedia mobile applications. In the final week, each team will have to submit their research report (worth 10%) explaining the research problem, research methods used, analysis and the conclusion highlighting the research findings and results. The report must explain precisely the work accomplished by each student. Each team will be | A1, A2, B1, B2, B3, C1, C2, C3, D1, D2, D3,D4 | 16% |

| | | | |
|---|---|---|---|
| | required to make a presentation (worth 6%) summarizing the research conducted and its findings. Each team member has to participate in the presentation. Team-based work will be examined and evaluated as a whole as well as the individual work of each student. Team members will be tested individually during the presentation by peers and the instructor. | | |
| Final Exam | The final exam is comprehensive and will be of two hours duration. It will consist of short-answer, essay and problem-solving questions. Students will be asked to design and write the code of some components of mobile applications. | A1, A2, B1, B2, B3, C1, C2, C3 | 40% |
| **Overall:** | | | **100 %** |

| Admissions | |
|---|---|
| **Pre-requisites** | **None** |
| **Minimum number of students** | **4** |
| **Maximum number of students** | **20** |

## COLLEGE OF INFORMATION TECHNOLOGY

## DEPARTMENT OF INFORMATION TECHNOLOGY

## COURSE SYLLABUS/ SPECIFICATION

**Course Code & Title:**     **ITCS 520 – Big Data Analytics**

**Weight:**     **(3 - 0 - 3)**

**Prerequisite:**     **ITCS 511**

**NQF Level Allocated:**     **9**

**NQF Notional Hours / Credits:**    **120 notional hours/ 12 NQF credit**

**Description:** This course covers foundational techniques and tools required for data science and big data analytics. The course focuses on concepts, principles, and techniques applicable to any technology environment and industry with emphasis on systems and algorithms for large-scale advanced data analysis. Topics covered include concepts and algorithms for building big data systems, data analytics lifecycle, basic and advanced analytics methods, and emerging big data technology and tools.

**Objective:**

1. To explain advanced big data analytics concepts, techniques and methods.
2. To teach students how to apply big data analytics lifecycle and use advanced tools to address real business problems.
3. To explain and demonstrate the effective use of emerging big data technologies such as Hadoop and MapReduce

**Semester:**

**Instructor (s):**

**Office Telephone:**                      **Email (s):**

**Intended Learning Outcomes (ILOs):**

| A. Knowledge and Understanding | | NQF Descriptor/ Level |
|---|---|---|
| A1 | **Concepts and Theories:** Demonstrate extensive knowledge and critical understanding of key concepts and theories of big data analytics. | Knowledge: theoretical understanding [Level 9] |
| A2 | **Contemporary Trends, Problems and Research:** Demonstrate an informed and critical awareness of the current trends and advancements in big data analytics techniques, technologies and applications. | Knowledge: theoretical understanding [Level 9] |
| A3 | **Professional Responsibility:** Demonstrate knowledge and understanding of techniques used to preserve appropriate level of privacy and security needed in big data systems. | Knowledge: theoretical understanding [Level 9] |

| B. Subject-specific Skills | | NQF Descriptor/ Level |
|---|---|---|
| B1 | **Problem Solving:** Develop solutions for business-related problems by applying the big data analytics lifecycle including discovery and formalization, data preparation, planning, implementation and results communication. | Skills: Communication, ICT and Numeracy Skills [Level 9] <br><br> Knowledge: Practical Understanding [Level 9] |
| B2 | **Modeling and Design:** Develop appropriate models for big data systems and visualization of analytics results to convey clear insights. | Knowledge: Practical Understanding [Level 9] |
| B3 | **Application of Methods and Tools:** Apply effectively the appropriate big data analytic methods and tools used to analyze big data and facilitate informed decision making (such as Rstudio, Hadoop and MapReduce). | Skills: Communication, ICT and Numeracy Skills [Level 9] |

| | | Knowledge: Practical Understanding [Level 9] |
|---|---|---|

| C. Critical-Thinking Skills | | NQF Descriptor/ Level |
|---|---|---|
| C1 | **Analytic skills:** Analyze sets of big data critically to generate useful insights and inform decision making. | Generic cognitive skills [Level 9] |
| C2 | **Synthetic:** Identify technological requirements, architecture, and infrastructure needed to build up big data systems and address risk related issues. | Generic cognitive skills [Level 9] |
| C3 | **Creative Thinking and innovation:** Identify new areas and ways to apply and communicate results of big data analytics lifecycle creatively to support insights and address emerging business challenges. | Generic cognitive skills [Level 9] |

| D. General and Transferable Skills (other skills relevant to employability and personal development) | | NQF Descriptor/ Level |
|---|---|---|
| D1 | **Communication:** Express and convey ideas rigorously and effectively, in written and oral form, to a diverse range of stakeholders using visualization techniques and tools. | Communication, ICT and Numeracy Skills [Level 9] |
| D2 | **Teamwork and Leadership:** Work effectively as a member/leader of a team in order to complete a big data analytics research project. | Competence: Autonomy & Responsibility [Level 9]  Competence: Learning to learn [Level 9] |
| D3 | **Organizational and Developmental Skills:** Engage in life-long learning and continuing self-development to enhance and practice professional and organizational skills in order to effectively prioritize, plan, manage and allocate appropriate time to implement tasks in big data projects and assignments. | Competence: Learning to learn [Level 9] |
| D4 | **Ethics and Social Responsibility:** Understand and demonstrate awareness of the benefits that big data analytics bring to organizations and the ethical and privacy risks they might pose. | Competence- Insight [Level 8] |

## Course Structure (Outline)

| Week | Hours | | ILOs | Topics | Teaching Method | Assessment Method |
|------|------|------|------|--------|-----------------|-------------------|
| | Lec. | Lab | | | | |
| 1 | 3 | - | A1 | **Introduction and overview:** Structured vs. unstructured data, relational databases, big data concepts, characteristics and importance, data sciences and analytics. | Lecture | Class Participation (A1) |
| 2 | 2 | - | A1,B1,B2,C1,C2 | **Examples of big data applications and solutions for business problems:** strategic planning, platform | Lecture/ case study/ discussion/ group debate | Class Participation (A1, C2) |
| 2 | 1 | - | A1,A3,C1,C2,D4 | **Examples of big data applications and solutions for business problems:** security and privacy concerns, risk management. | Lecture/ case study/ discussion/ group debate | Class Participation (A1,C1,D4) |
| 3 | 2 | - | A1,B1,B2,C2, D3 | **Data Analytics Lifecycle:** Discovery, Data Preparation, Model Planning, Model Building, | Lecture | **Research Assignment 1 (A1,B1,B2,C2, D3)** / Class Participation (A1) |
| 3 | 1 | - | A1,B1,B2,C1,D1 | **Data Analytics Lifecycle:** Results Communication, Operationalization | Lecture | Class Participation (A1,D1) |
| 4 | 2 | - | A1, B2,B3,D1,D3 | **Basic Data Analytic Methods**: Introduction to RStudio | Lecture/ Lab session demo | Class Participation (A1) |
| 4 | 1 | - | A1,B2, B3,C1, D1, D3 | **Basic Data Analytic Methods**: analyzing and exploring data by R | Lecture/ Lab session demo | **Project 1** (B2,B3,C1, D3) /Class Participation (A1,D1) |

| 5 | 1 | - | A1,B2, B3,C1, D1, D3 | **Basic Data Analytic Methods**: analyzing and exploring data by R | Lecture/ Lab session demo | Class Participation (A1,D1) |
|---|---|---|---|---|---|---|
| 5 | 2 | - | A1, B2,B3,C1,C 2,C3, | **Basic Data Analytic Methods**: statistics for model building and evaluation | Lecture | Class Participation (A1) |
| 6 | 3 | - | A1,B1,C1,C 2, D1 | **Advanced Data Analytics Theory And Methods:** Supervised & unsupervised learning | Lecture/use cases | Class Participation (A1) |
| 7 | 2 | - | A1,B1,B2,C 1,C2,C3 | **Advanced Data Analytics Theory And Methods:** clustering, association rules | Lecture/use cases | **Research Assignment 2** (A1, B1, B2, C1, C2, C3)/ Class Participation (A1, C1) |
| 7 | 1 | - | A1,B1,B2,C 1,C2,C3 | **Advanced Data Analytics Theory And Methods:** regression, classification | Lecture/use cases | Class Participation (A1, C1) |
| 8 | 2 | - | A1,B1,B2,C 1,C3 | **Advanced Data Analytics Theory And Methods:** decision trees, time series analysis, text analysis | Lecture/use cases | **Midterm Exam (**A1,B1,B2,C1,C3**)** / Class Participation (A1, C1) |
| 8 | 1 | - | A1, B2, C2,C3 | **Advanced Data Analytics Theory And Methods:** networks and graphical models, Dimension reduction | Lecture/use cases | Class Participation (A1) |
| 9 | 3 | - | A1,B1,B2,C 1,C2 | **Advanced Technologies and Tools:** Data storage and analytics for unstructured data | Lecture | Class Participation (A1,C1) |
| 10 | 3 | - | B2,B3,C1,C 2,D1,D3 | **Advanced Technologies and Tools:** MapReduce and Hadoop, Hadoop Ecosystem | Lecture/ Lab session demo | Class Participation (A1, D1) |
| 11 | 3 | - | A1,B2,B3,C 1,C2 | **Tools for SQL-like access to unstructured data**: Pig and Hive | Lecture/ Lab session demo | **Project 2** (B2,B3,C1, C2) / Class Participation |

| | | | | | | (A1) |
|---|---|---|---|---|---|---|
| 12 | 3 | - | A1,B2,B3,C1,C2, D3 | **NoSQL storage solutions**: HBase, Cassandra, and Oracle NoSQL, | Lecture/ Lab session demo | Class Participation (A1) |
| 13 | 3 | - | A1,A3,B1,B2,C3,D1,D4 | **Operationalization of data Analytics Project:** Creating the final deliverables, data visualization techniques, privacy, ethics, governance | Lecture | Class Participation (A3,D4) |
| 14 | 3 | - | A1, A2,A3, B1, C3,D1,D4 | **Research & Trends:** Cloud & big data, SaaS business intelligence, globally distributed storage systems, Google data center infrastructure, data visualization, automation, semantics, predictive analytics, social media analytics | Lecture/ discussion/ group debate | Class Participation (A1, D4) |
| 15 | 3 | - | A1,A2, A3, B1,B2,B3, C1,C2,C3, D1,D2, D3, D4 | Team research project report and presentations by students | Students Project Presentations | **Evaluation of Research Project Outcomes and Presentations (**A1,A2, A3, B1,B2,B3, C1,C2,C3, D1,D2, D3, D4**)** |
| 16 | 2 | - | | | | Final Exam ( A1, A3, B1,B2,B3, C1,C2, D4) |

## Teaching Materials:

| | |
|---|---|
| **Textbook(s):** | 1- Nataraj Dasgupta, *Practical Big Data Analytics,* Packt Publishing, 2018. <br> **2-** Cory Lesmeister. *Matering Machine Learning with R – Second Edition*. Packt Publishing, 2017. |
| **Handout(s):** | Power point slides, http://www.ahlia.edu.bh/moodle. |
| **Reference(s):** | 1. Hadley Wickham, Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, Shroff/O'Reilly, 2017. |

| | 1. Sunila Gollapudi, Practical Machine Learning, Packt Publishing, 2016. |
|---|---|
| | 2. M. Minelli, M. Chambers and A. Dhiraj, Fundamentals of Deep Learning: Designing next generation Machine Intelligence Algorithms, Shroff/O'Reilly, 2017. |
| | 3. Sam R. Alapati, Expert Hadoop Administration: Managing, Tuning, and Securing Spark, YARN, HDFS, First Edition, Pearson Education, 2017. |
| | 4. Gurmukh Singh, Hadoop 2.x Administration Cookbook, Packt Publishing, 2017. |
| | 5. Dipayan Dev, Deep Learning with Hadoop, Packt Publishing, 2017. |
| | 6. Dr. PKS Prakash, R Deep Learning Cookbook, Packt Publishing, 2017. |
| | 7. Tom M. Mitchell, Machine Learning, First edition, McGraw Hill Education, 2017. |
| | 8. http://www.rstudio.com/ |
| | 9. https://mran.microsoft.com/open |
| | 10. http://tdwi.org/ |
| | 11. More references are available in the course website in Moodle. |

## Assessment

| Type of Assessment[1] | Description[2] | ILOs[3] | Weighting |
|---|---|---|---|
| Research Assignment 1 | The assignment consists of 6-8 essay, problem-solving and research based theoretical questions regarding topics in big data analytics covered during the first 3 weeks. The purpose of the assignment is to assess students individually where they have to demonstrate their extensive and detailed knowledge and critical understanding of key concepts, theories, methods, tools and techniques of big data analytics. The assignment will also assess students' skills to solve and develop solutions for business-related problems by applying the big data analytics lifecycle. Soft copy submission is required by the end of the 4th week through the course page in Moodle where answers will be checked by Turnitin against plagiarism. | A1, B1, B2, C2, D3 | 7% |
| Research Assignment 2 | Similar to assignment 1 but topics will cover up to week 7. Soft copy submission is required by the end of the 8th week through the course page in Moodle where answers will be checked by Turnitin against plagiarism. | A1, B1, B2, C1, C2, C3 | 7% |
| Project 1 | The practical project will assess students' skills in utilizing the R language and RStudio to analyze and explore big data. The students will be given examples of big data sets and will be asked to analyze them using R language and RStudio. Soft copy of the | B2,B3,C1, D3 | 7% |

| | | | |
|---|---|---|---|
| | output should be submitted electronically by the end of week 5. | | |
| Project 2 | Students will be given a set of practical tasks to be implemented on real examples of big data using MapReduce, Hadoop, Pig and Hive. The purpose of the project is to assess students' skills (individually) in using the advanced big data analytics techniques and methods learned in class. Soft copy of the output should be submitted electronically by the end of week 12. | B2,B3,C1, C2 | 7% |
| Midterm Exam | The midterm exam will be an in-class 1-hour exam that will consists of short-answer, essay, and problem solving questions and cover the topics studied in the first 8 weeks. | A1,B1,B2,C 1,C3 | 20% |
| Team Research Project Report and Presentation | Starting from weak 4, the class will be divided into teams of 4-5 students and each will be asked to study a research problem in big data analytics utilizing the skills and tools learned in class. Teams are required to plan and execute the research project that may involve the application of advanced and specialized big data techniques, skills and tools to develop solutions for business-related problems by applying the big data analytics lifecycle. In the final week, each team will have to submit their research report (worth 10%) explaining the research problem, research methods used, analysis and the conclusion highlighting the research findings and results. The report must explain precisely the work accomplished by each student. Each team will be required to make a presentation (worth 6%) summarizing the research conducted and its findings. Each team member has to participate in the presentation. Team-based work will be examined and evaluated as a whole as well as the individual work of each student. Team members will be tested individually during the presentation by peers and the instructor. | A1,A2, A3, B1,B2,B3, C1,C2,C3, D1,D2, D3, D4 | 12% |
| Final Exam | The final exam is a 2-hour closed book and notes comprehensive exam. It will consist of short-answer, essay and problem-solving questions in big data analytics. | A1, A3, B1,B2,B3, C1,C2,C3, D4 | 40% |
| | | Overall | 100% |

| Admissions | |
|---|---|
| **Pre-requisites** | **ITCS 511** |
| **Minimum number of students** | **4** |
| **Maximum number of students** | **20** |

**College of Information Technology**
**Department of Information Technology**
<u>**COURSE SYLLABUS/ SPECIFICATION**</u>

| | |
|---|---|
| **Course Code & Title:** | **ITCS 526: Cloud Computing** |
| **Weight:** | **(3 - 0 - 3)** |
| **Prerequisite:** | **None** |
| **NQF Level Allocated:** | **9** |

**NQF Notional Hours / Credits:**   120 National Hours/12 NQF Credits

**Description:**    This course covers how to build a cloud infrastructure based on a cloud computing reference model. The reference model includes five fundamental layers, namely, physical, virtual, control, and service and three cross-layer functions, namely business continuity, security, and service management for building a cloud infrastructure. For each layer and function, this course covers the comprising technologies, components, processes, and mechanisms. This course takes an open approach to describe concepts and technologies. Product examples are included to reinforce the concepts and technologies learnt in this course .

After completing this course, students will acquire knowledge to make informed decisions on technologies, processes, and mechanisms that are required to build cloud infrastructure

**Objectives:**

1. To explain Cloud computing advanced and specialist concepts and principles
2. To discuss various approaches in cloud computing services,
3. 3. To explore cloud computing security and performance.

**Semester:**

**Instructor:**

**Office Telephone:**

**Email (s):**

**Intended Learning Outcomes (ILOs):**

| A. Knowledge and Understanding | | NQF Descriptor/ Level |
|---|---|---|
| **A1** | Concepts and Theories: Demonstrate knowledge and critical understanding of concepts and theories related to architecture of Cloud Computing and its services and appreciate the importance of security aspects through cloud computing solutions. | Knowledge: theoretical understanding [Level 9] |
| **A2** | Contemporary Trends, Problems and Research: Demonstrate an informed and critical awareness of the cloud computing problems, research issues and technological advancements. | Knowledge: theoretical understanding [Level 9] |
| **A3** | Professional Responsibility: Demonstrate cognizance of and adhere to the professional and legal standards as a cloud computing user/consumer. | Knowledge: theoretical understanding [Level 9] |
| **B. Subject-specific Skills** | | **NQF Descriptor/ Level** |
| **B1** | Problem Solving: Identify appropriate cloud computing service, plan an implementation approach, and its corresponding scope for the discussed cases. | Knowledge: theoretical understanding [Level 9]<br><br>Communication, ICT and Numeracy Skills [Level 9] |
| **B2** | Modeling and Design: Model and design a cloud solution using one of the cloud computing services. | Knowledge: practical application [Level 9] |
| **C. Critical-Thinking Skills** | | **NQF Descriptor/ Level** |
| **C1** | Analytic: Critically evaluate cloud computing services and possible approaches including identification of the corresponding benefits and challenges for each implementation. | Generic Problem Solving & Analytical skills [Level 9] |
| **C2** | Synthetic: Design and model full cloud computing scenario including strategic objective(s) identification, corresponding service(s) selection, and the desired approach and scope implementation. | Generic Problem Solving & Analytical skills [Level 9] |
| **D. General and Transferable Skills (other skills relevant to employability and personal development)** | | **NQF Descriptor/ Level** |
| **D1** | Communication: Express and communicate ideas cogently, persuasively and effectively, in written and oral form, to a diverse range of audiences and stakeholders through written | Communication, ICT and Numeracy Skills [Level 9] |

| | | |
|---|---|---|
| | test, final examination, group assignment, and research project. | |
| **D2** | <u>Teamwork and Leadership:</u> Work effectively as a member/leader of a team of technical people who may plan, design, implement, manage, monitor and evaluate a cloud computing solution scenario. | Competence: Autonomy, Responsibility and Context [Level 9] |
| **D4** | <u>Ethical and Social Responsibility:</u> Demonstrate awareness of, and adhere to, ethical and societal responsibilities in the area of cloud computing. | Competence: Autonomy, Responsibility and Context [Level 9] |

## Course Structure (Outline)

| Week | Hours Lec. | Hours Lab | ILOs | Topics | Teaching Method | Assessment Method |
|---|---|---|---|---|---|---|
| | **Hours** | | | | | |
| 1 | 3 | 0 | A1, A3 | **General Introduction** | Lecture | - |
| 2 | 3 | 0 | A1,A2, A3,C1 | **Cloud Architecture:** Building the cloud Infrastructure Cloud Computing Reference Model Options for Building Cloud Infrastructure Consideration for Building cloud Infrastructure | Lecture, Group Discussion | Assignment 1 2% A2, A3, C1, D1 |
| 3 | 3 | 0 | A1,A3, B1,C1 | **Cloud Physical Layer:** Considerations for designing cloud physical layer | Lecture | Assignment 2 2% |
| 4 | 3 | 0 | A1,B2, D2,D4 | **Cloud Physical Layer (cont.):** Compute system Software Deployment on Compute Systems Types of Compute Systems | Software Demonstratio n, Group Discussion | - |
| 5 | 3 | 0 | A1,A3, B1,C1 | **Cloud Physical Layer(cont.):** Storage System Considerations Network System Considerations | Lecture | Test1 A1, B1, C1, D1 |
| 6 | 3 | 0 | A1,B2, D2,D4 | **Cloud Virtual Layer:** Preparations for Resource Pool Introducing Virtual Resources | Software Demonstratio n, Group Discussion | Assignment 3 2% A2, A3, C1, D1 |
| 7 | 3 | 0 | A1,A3, B1,C1 | **Cloud Control Layer:** Types of Control Software Software-defined approach for managing IT resources in a cloud environment | Lecture | - |
| 8 | 3 | 0 | A1,B2, D1,D2, D4 | **Cloud Control Layer (cont.):** Software defined Approach for managing cloud Resource Management Techniques | Software Demonstratio n, Group Discussion | - |
| 9 | 3 | 0 | A1, B1,C1, C2, D1 | **Cloud Service Orchestration Layer:** Cloud Portal Interface Standards and Protocol | Lecture | Assignment 4 2% A2, A3, C1, D1 |
| 10 | 3 | 0 | A1, C1, C2, D2 | **Service Orchestration Layer (cont.):** Service orchestration Cloud Service Lifecycle | Lecture, Group Discussion | - |
| 11 | 3 | 0 | A1,A2 B2,C1, C2,D2 | **Cloud Business Continuity:** Building Fault Tolerance Cloud Infrastructure | Lecture, Group Discussion | Test 2 A1, B1, C1, D1 |
| 12 | 3 | 0 | A1,A2 B2,C1, C2,D2 | **Cloud Business Continuity (cont.):** Data Protection Solution-Backup Data Protection Solution-Replication Application Resiliency for cloud | Lecture, Group Discussion | Assignment 5 2% A2, A3, C1, D1 |

| 13 | 3 | 0 | A1,A2 B2,C1, C2,D2 | **Cloud Security:** Cloud Security Threats Cloud Security Mechanisms | Lecture, Group Discussion | - |
| **14 and 15** | 3 | 0 | B2,D1, D2,D4 | **Students Group Project** (Presentations and Reports) | Group Discussion | **Group Project Evaluation** B2,D1,D2,D4 |
| **16** | 2 | | | | | **Final Exam** A1,B1,C1,C2, D1 |

**Teaching Materials:**

| | |
|---|---|
| **Textbook(s):** | 1. Bhowmik, Sandeep (2017), *Cloud Computing*. Cambridge University Press, 1st Ed., ISBN-13: 978-1316638101<br>2. Ray Rafaels (2018), Cloud Computing. CreateSpace Independent Publishing, 2nd Ed., ISBN- 978-1986726283 |
| **Handout(s):** | Course notes and other teaching material available in **the course website in Moodle.** |
| **Reference(s):** | 1. Rittinghouse, John W., and James F. Ransome. (2016), Cloud computing: implementation, management, and security. CRC press.<br>2. Michael Collier and Robin Shahan; "Fundamentals of Azure", Second Edition 2016.<br>3. Thomas Erl, Ricardo Puttini and Zaigham Mahmood; "Cloud Computing: Concepts, Technology & Architecture", the Prentice Hall Service Technology Series from Thomas, May 20, 2013.<br>4. EMC Corporation "Cloud Infrastructure and Services Version 2 Student Guide", 2014 Edition |

**Assessments:**

| Type of Assessment[1] | Description[2] | ILOs[3] | Weighting |
|---|---|---|---|
| **Tests** | Two one hour Tests each 15 %. Test one cover topics from week 1 to week 5. Test two cover topics from week 6 to week 11. | A1, B1, C1 | 30% |
| **Research Assignments:** (Report) | Each student has to select a recently published article (within last 5 years) related to one of the specified cloud computing topics and analyse, present, and discuss it in the class. | A2, A3, C1, D1 | 10% |
| **Group Project:** (Oral Presentation, Teamwork, and Report) | The class will be divided into groups, each group has to present a cloud solution proposal related treating specified technical problem. | A2, B1, B2, D1, D2, D4 | 20% |
| **Final Exam:** | Two-hour Final Exam consisting of essay | A1, B1, B2, C1, C2 | 40% |

| | questions.  The exam will cover all the topics in the course syllabus. | | |
|---|---|---|---|

| | **Overall** | **100%** |
|---|---|---|
| | | |

| **Admissions** | |
|---|---|
| **Minimum number of students** | 4 |
| **Maximum number of students** | 25 |

**Ahlia University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see** www.ahlia.edu.bh/integrity **for more information).**

**AHLIA UNIVERSITY**
**BAHRAIN**

**DEPARTMENT OF INFORMATION TECHNOLOGY**

**COURSE SYLLABUS/ SPECIFICATION**

**Course Code & Title:** ITCS 527/ Advanced Networking

**Weight:** (3-0-3)

**Prerequisite:** None

**NQF Level Allocated:** 9

**NQF Notional Hours / Credits:** 120 notional hours/ 12 NQF credit

**Description:**

This course is to describe the advanced concepts of networking, Networking and interconnectivity, Application networking services such as design the architecture and services of email systems and describe the role of networking in file service applications, network management, and wireless and mobile networking.

**Objectives:**

1. To provide in-depth theoretical and applied knowledge in advanced and complex network technologies.
2. To discuss relevant management issues and devise adequate network management solutions.
3. To identify and assess possible research opportunities and difficulties within the scope of advance networks
4. To cover the key concepts in performing trade-off analysis which are important to the network architecture.

**Semester:**

**Instructor (s):**

**Office Telephone:** **Email** **(s):**

**Intended Learning Outcomes (ILOs):**

| | A. Knowledge and Understanding | NQF Descriptor/ Level |
|---|---|---|
| A1 | **Concepts and Theories:** Demonstrate critical knowledge and understanding of concepts and theories related to data networking and associated layers. | Knowledge: theoretical understanding [Level 9] |
| A2 | **Contemporary Trends, Problems and Research:** Demonstrate critical awareness of specialized internetworking problems, research issues and technological advancements. | Knowledge: theoretical understanding [Level 9] |
| A3 | **Professional Responsibility:** Demonstrate cognizance of and adhere to the professional and legal standards as a network user/consumer. | Knowledge: theoretical understanding [Level 9] |

| | B. Subject-specific Skills | NQF Descriptor/ Level |
|---|---|---|
| B1 | **Problem Solving:** Identify complex and unpredictable internetworking problems and provide relevant specialized solutions. | **Skills**: Communication, ICT and Numeracy [Level 9] Knowledge: Practical application [Level 9] |
| B2 | **Modeling and Design:** Model and design creative protocols/ components for wired and wireless networks | Knowledge: Practical application [Level 9] |
| B3 | **Application of Methods and Tools:** Use effectively the specialist simulation software to implement originally designed internetworking techniques/protocols. | Knowledge: Practical application [Level 9] Communication, ICT and Numeracy Skills [Level 9] |

| | C. Critical-Thinking Skills | NQF Descriptor/ Level |
|---|---|---|
| C1 | **Analytic skills:** Critically evaluate and test the performance of internetworking protocols within lower/upper layers considering identification of the corresponding benefits and challenges for each implementation. | Generic Problem Solving & Analytical skills [Level 9] |
| C2 | **Synthetic:** Link internetworking lower/upper layers through appropriate protocols in order to provide end-to-end communication corresponding to the desired application demands and user expectation. | Generic Problem Solving & Analytical skills [Level 9] |
| C3 | **Creative Thinking and innovation:** | N/A |

| | D. General and Transferable Skills (other skills relevant to employability and personal development) | NQF Descriptor/ Level |
|---|---|---|
| D1 | **Communication:** Express and communicate ideas cogently, persuasively, and effectively, in written and oral form, to a diverse range of audiences. | Skills: Communication, ICT and Numeracy [Level 9] |
| D2 | **Teamwork and Leadership:** Operate at a professional level and work effectively as a member/leader of a team in order to complete a pre-defined and complex research project. | Competence: Autonomy, Responsibility and Context [Level 9] |
| D3 | **Organizational and Developmental Skills:** | N/A |
| D4 | **Ethics and Social Responsibility:** | N/A |

**Course Structure (Outline)**

| Course Structure (Outline) | | | | | | |
|---|---|---|---|---|---|---|
| Week | Hours | | ILOs | Topics | Teaching Method | Assessment Method |
| | Lec. | Lab | | | | |
| 1 | 3 | - | A1 | **Introduction** | Lecture/ Class Discussion | - |
| 2 | 3 | - | A1, A3, B2, D1 | **Network Applications** <br> -Network Application Architectures. <br> -Application-layer protocols. <br> - Electronic Mail in Internet. <br> -Peer-to-Peer Applications. | Lecture/ In-class Exercises | Oral Participation |
| 3 | 3 | - | A1, B1, B2, B3, C1, C2 | **Socket Programming: Creating Network Application** <br><br> - Socket Programming with UDP. <br> - Socket Programming with TCP. | Lecture/ In-class Exercises/ Practical Demonstration | In-class Exercises |

| | | | | | | |
|---|---|---|---|---|---|---|
| 4 | 3 | - | A1, C1, D1 | **Transport Layer**<br>- Transport-layer services.<br>- Connectionless Transport: UDP<br>- Connection-Oriented Transport: TCP | Lecture/ In-class Exercises | Oral Participation |
| 5 | 3 | - | A1, A2, B1, C1 | **Congestion Control**<br>- The causes and the Costs of Congestion.<br>- Advanced approaches to congestion control. systems | Lecture/ In-class Exercises | Oral Participation **Assignment 1** |
| 6 | 3 | - | A1, D1 | **Network Layer**<br><br>- Forwarding and Routing.<br>- Network Service Models | Lecture/ In-class Exercises/ Case Studies | Oral Participation |
| 7 | 3 | - | A1, B1, D1 | **Link Layer**<br>- Links, Access Networks and LANs<br>- Error Detection and Correction Techniques | Lecture/ In-class Exercises/ Case Studies | Oral Participation |
| 8 | 3 | - | A1, B1, B2, C1, D1 | **Internet routing Protocols**<br>- IPv4, addressing and IPv6.<br>- Network Addressing Translation.<br>- Contrast an IPv4 subnet with an IPv6 subnet. | Lecture/ In-class Exercises/ Case Studies | Oral Participation **Major Exam** |
| 9 | 3 | - | A1, A2, C1, D1 | **Advanced routing algorithms**<br>- The Link-State (LS) algorithm.<br>- The Distance-Vector (DV) algorithm. | Lecture/ In-class Exercises/ Case Studies | Oral Participation |
| 10 | 3 | - | A1, B2, C1, C2 | **Wireless Networks**<br>- Wireless Links and network characteristics.<br>- WiFi Architecture, protocol and Frame<br>- Advanced Features in wireless network. | Lecture/ In-class Exercices | In-class Exercices |

| | | | | | | |
|---|---|---|---|---|---|---|
| 11 | 3 | - | A1, A2, B1, C1 | **Mobile Networks**<br>- Cellular Network Architecture<br>- Cellular Dara Networks.<br>- 4G, 5G and Advanced LTE technologies | Lecture/ In-class Exercices | **Assignment 2** |
| 12 | 3 | - | A1, C1, C2 | **Wireless and Mobility**<br><br>Impact on Higher-Layer Protocols | Lecture/ In-class Exercises/ Case Studies | Oral Participation |
| 13 | 3 | - | A1,C1 | **Multimedia Networking**<br>- Multimedia networking application<br>- Streaming stored video<br>- Voice over IP | Lecture/ In-class Exercises | In-class Exercises |
| 14 | 3 | - | A1, A3, B1, C1 | **Security in computer network** | Lecture/ In-class Exercises/ Independent Learning | In-class Exercises |
| 15 | 3 | - | A1, A2, A3, B1, B2, B3, C1, C2, D1, D2 | Project | student project presentations | Evaluation of **Team Project Presentations & Reports** |
| 16 | 2 | - | A1, B1, B2, C1, C2 | Final Examination | | |

**Teaching Materials:**

| | |
|---|---|
| **Textbook(s):** | 1. Kurose, Jim, and Keith Ross. "Computer Networking: A Top Down Approach", 2017.Pearson. ISBN 9780133594140.<br>2. Gerry Howser, "Computer Networks and the Internet", 1st edition, 2020, Springer, ISBN-13: 978-3030344955. |
| **Handout(s):** | Power point slides,  http://www.ahlia.edu.bh/moodle. |

| | |
|---|---|
| **Reference(s):** | 1. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, 2013, Mc Graw Hill, ISBN13: 9780073376226<br>2. Adeli, Hojjat, and Maricei Balitanas. "Advanced communication and networking." (2019).<br>3. Barolli, L., Amato, F., Moscato, F., Enokido, T. and Takizawa, M. eds., 2020. Advanced Information Networking and Applications: Proceedings of the 34th International Conference on Advanced Information Networking and Applications (AINA-2020) (Vol. 1151). Springer Nature. |

**Assessment**

| Method of Assessment | Description | Learning Outcomes | Weighting |
|---|---|---|---|
| Assignments | Two assignments each worth 10% and consists of essay, problem-solving and research based theoretical and case studies. The purpose of the assignment is to assess students individually where they have to demonstrate their extensive and detailed knowledge and critical awareness of current research, trends and advancements in network applications. The assignment will also assess students' skills in evaluating effective network that has to be discovered through research. Soft copy submission is required through the course page in Moodle where answers will be checked by Turnitin against plagiarism. | A1, A2, B1, C1 | 20% |
| Oral Participation | Students will be questioned orally to demonstrate their understanding and knowledge of the topics covered during class lectures. Feedback will be given to students to reaffirm their learning outcomes. | D1,A1 | Formative |
| In- Class Exercises | In-class exercises consist of problem solving and application of different tools. Each exercise will be one hour duration. | B1,C1 | Formative Assessment |
| Major Exam | The midterm exam will be an in-class 1-hour exam that will consists of short-answer, essay, and problem solving questions and cover the topics studied in the first 8 weeks. | A1, B1, B2, C1 | 20% |

| | | | |
|---|---|---|---|
| Project | Starting from weak 4, the class will be divided into teams of 4-5 students and each will be asked to study a research problem in AI and machine learning utilizing the skills and tools learned in class. Teams are required to plan and execute the research project that may involve the application of advanced data networks and tools to develop efficient network connectivity. In the final week, each team will have to submit their research report (worth 14%) explaining the research problem, research methods used, analysis and the conclusion highlighting the research findings and results. The report must explain precisely the work accomplished by each student. Each team will be required to make a presentation (worth 6%) summarizing the research conducted and its findings. Each team member has to participate in the presentation. Team-based work will be examined and evaluated as a whole as well as the individual work of each student. Team members will be tested individually during the presentation by peers and the instructor. | A2, A3, B1, B2, B3, C1, C2, D1, D2, | 20% |
| Final Exam | The final exam is comprehensive and will be of two hours duration. It will consist of short-answer, essay and problem-solving questions. | A1, B1, B2, C1, C2 | 40% |
| **Overall:** | | | **100 %** |

| Admissions | |
|---|---|
| **Pre-requisites** | (None) |
| **Minimum number of students** | 4 |
| **Maximum number of students** | 20 |

**COLLEGE OF INFORMATION TECHNOLOGY**

**DEPARTMENT OF IT**

<u>**COURSE SYLLABUS/ SPECIFICATION**</u>

**Course Code & Title:**       ITCS 528- Cyber Security

**Weight:**                              (3-0-3)

**Prerequisite:**                     None

**NQF Level Allocated:**        9

**NQF Notional Hours / Credits:**   120 notional hours/ 12 NQF credit

**Description:** This course covers the advanced techniques of security systems development, Internet security, malware, different security mechanisms, such as encipherment, authentication, and information hiding, used to protect the elements of information systems, and specifically transmitted, stored, and processed data. It also covers the security considerations that should be evaluated for each stage in the lifecycle of a product, and securing software development including the use of safe language, static analysis of software, and dynamic software testing.

**Objective:**

1. To critically explore various security mechanisms.
2. To understand a range of specialized theories, principles and concepts of cyber security.
3. To explain specialist models and methods in developing security systems.
4. To illustrate the software supply chain, and how to consider security in each development stage.
5. To research current trends in cyber security.

**Semester:**

**Instructor (s):**

**Office Telephone:**                    **Email (s):**


**Intended Learning Outcomes (ILOs):**

| A. Knowledge and Understanding | | NQF Descriptor/ Level |
|---|---|---|
| A1 | **Concepts and Theories:** Demonstrate critical knowledge and understanding of a range of specialized theories, principles and concepts of software cyber security. | Knowledge: theoretical understanding [Level 9] |
| A2 | **Contemporary Trends, Problems and Research:** Demonstrate critical awareness of the current research, trends and advancements in cyber security. | Knowledge: theoretical understanding [Level 9] |


| B. Subject-specific Skills | | NQF Descriptor/ Level |
|---|---|---|
| B1 | **Problem Solving:** Use a variety of complex approaches to identify security problems in order to provide effective solutions. | Knowledge: Practical Application [Level 9] Skills: Communication, ICT & Numeracy [Level 9] |
| B2 | **Modeling and Design:** Apply a range of specialist methods to develop security system components. | Knowledge: Practical Application [Level 9] |
| B3 | **Application of Methods and Tools:** Apply appropriate complex methods and tools for securing information systems. | Knowledge: Practical Application [Level 9] Skills: Communication, ICT & Numeracy [Level 9] |

| C. Critical-Thinking Skills | | NQF Descriptor/ Level |
|---|---|---|
| C1 | **Analytic skills:** Critically analyze the security level of various cyber security techniques. | Generic Problem Solving & Analytical skills [Level 9] |
| C2 | **Synthetic:** Critically synthesize cyber security constructs in order to build security systems. | Generic Problem Solving & Analytical skills [Level 9] |
| C3 | **Creative:** Demonstrate creativity in the development of effective and efficient security systems to real world problems. | Generic Problem Solving & Analytical skills [Level 9] |

| D. General and Transferable Skills (other skills relevant to employability and personal development) | | NQF Descriptor/ Level |
|---|---|---|
| D1 | **Communication:** Develop an ability to effectively communicate with peers, and senior colleagues and presentations skills in project report writing and oral presentation. | Communication, ICT and Numeracy Skills [Level 8] |
| D2 | **Teamwork and Leadership:** Operate Professional level and work effectively as a member of a study group, and where appropriate lead or take the initiative, to complete the group project/assignments according to deadlines. | Competence: Autonomy, Responsibility and Context [Level 9] |
| D3 | **Organizational and Developmental Skills:** organize professionally and effectively to prioritize, plan, manage and allocate appropriate resources to implement tasks in complex projects. | Competence: Autonomy, Responsibility and Context [Level 9] |

## Course Structure (Outline)

| Week | Hours | | ILOs | Topics | Teaching Method | Assessment Method |
|---|---|---|---|---|---|---|
| | Lec. | Lab | | | | |
| 1 | 3 | - | A1 | Introduction | Lecture/ Class Discussion | |
| 2 | 3 | - | A1 | Vulnerabilities, threats, and risk | Lecture/ Class Discussion | Case Study |
| 3-5 | 9 | - | A1, B1, B2, C1, C2 | Security Systems Development and Risk Management | Lecture/ Class Discussion/ In-Class Exercises

Independent Learning | Assignment1/ In-Class Exercises |
| 6-7 | 6 | - | A1, A2, B1, B2, B3, C1, D1, D3 | Security Mechanisms: Encryption | Lecture/ Class Discussion/ In-Class Exercises

Independent Learning | Assignment2/ In-Class Exercises |
| 8 | 3 | - | A1, B1, B2, B3, C1 | Security Mechanisms: Entity Authentication | Lecture/ In-Class Exercises | In-Class Exercises |
| 9 | 3 | - | A1, B1, B2, B3, C1 | Security Mechanisms: Message Authentication | Lecture/ In class exercises | Major Exam |
| 10 | 3 | - | A1, B1, B2, B3, C1 | Security Mechanisms: Information Hiding | Lecture/ In class exercises/ Case Studies | In-Class Exercises/ Case Studies |
| 11 | 3 | - | A1, B1, B3,C1, C2 | Internet Security | Lecture | Case Studies |
| 12-13 | 6 | - | A1, A2, C1, B1  D1, D3 | Malware analysis | Lecture/ Independent Learning | Assignment3 |
| 14 | 3 | - | A1, A2, B1, C1, C2 | Supply chain and software assurance | Lecture/ Independent Learning | |

| 15 | 3 | - | A2, B1,B2, B3, C1, C2, C3, D1, D2, D3 | Students Projects | project | Student Project Presentation |
|---|---|---|---|---|---|---|
| 16 | 2 | - | A1, B1,B2, B3,C1,C2 | | | Final Exam |

## Teaching Materials:

| Textbook(s): | 1. Whitman M. and Mattord H. (2014) *Principles of Information Security,* 5th Edition, Delmar Cengage Learning. 2. Stallings W. (2020) *Cryptography and Network Security: Principles and Practice*, 8th Edition, Pearson. |
|---|---|
| Handout(s): | Lecture Notes and Case Studies |
| Reference(s): | 1. Tipton H. F. and Nozaki M. K. *Information Security Management Handbook*, 6th Edition, Auerbach Publications. 2. Schneier B. (2015) *Applied Cryptography: Protocols, Algorithms andSource Code in C*, 20th Anniversary Edition, John Wiley & Sons. 3. Katz J. and Lindell Y. (2014) *Introduction to Modern Cryptography*, 2nd Edition, Chapman and Hall. 4. Rhodes-Ousley M. (2013) *Information Security the CompleteReference*, 2nd Edition, McGraw Hill Professional. 5. Gibson D. (2014) *Managing Risk in Information Systems (Information Systems Security & Assurance)*, 2nd Edition, Jones & Bartlett Learning. |

## Assessment

| Method of Assessment | Description | Learning Outcomes | Weighting |
|---|---|---|---|
| **Major Exam** | The major exam will be an in-class 90 minutes exam that will consists of short-answer, essay, and problem solving questions, and cover the topics studied in the first 9 weeks. | A1, B1,B2, B3, C1 | 20% |
| **Assignments** | The assignments consist of essay, problem-solving and literature review. The purpose of the assignments is to assess students where they have to demonstrate their extensive and detailed | A2, B1, B2, B3, C1, C3, D1, D3 | 20% |

| | | | |
|---|---|---|---|
| | knowledge and critical awareness of current research, trends and advancements in the cyber security mechanisms and development. Soft copy submission is required through the course page in Moodle where answers will be checked by Turnitin against plagiarism. | | |
| **Case Studies** | Different security cases are analyzed and studied. | A2, C1 | Formative |
| **In- Class Exercises** | In-class exercises consist of problem solving and application of different tools and methods to design security components. | B1,B2, B3 | Formative Assessment |
| **Team Project** | Student teams will propose and develop security systems. Soft copy submission is required through the course page in Moodle where the project report will be checked by Turnitin against plagiarism. | A2, B1,B2, B3, C1, C2, C3, D1, D2, D3 | 20% |
| **Final Exam** | The final exam is comprehensive and will be of two hours duration. It will consist of short-answer, essay and problem-solving questions. | A1, B1,B2, B3,C1,C2 | 40% |
| **Overall:** | | | **100 %** |

| Admissions | |
|---|---|
| **Pre-requisites** | None |
| **Minimum number of students** | 4 |
| **Maximum number of students** | 25 |

**Ahlia University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see** www.ahlia.edu.bh/integrity **for more information).**

COLLEGE OF INFORMATION TECHNOLOGY

DEPARTMENT OF INFORMATION TECHNOLOGY

COURSE SYLLABUS/ SPECIFICATION

Course Code & Title: ITCS 529 – Parallel and Distributed Systems

Weight: (3-0-3)

Prerequisite: None

NQF Level Allocated: 9

NQF Notional Hours / Credits: 120 notional hours/ 12 NQF credit

Description: This course covers the architecture and enabling technologies of parallel and distributed systems and their innovative applications. It will cover scalable multiprocessors, distributed clusters, P2P networks, computational Grids, and virtual machines. The course aims to acquaint students with state-of-the-art supercomputers and distributed systems for high-performance computing, e-commerce, and web-scale Internet applications.

Objective:

1. To critically understand parallel and distributed architectures, programming paradigms and algorithms.
2. To gain practice in developing and testing creative parallel and distributed system solutions.
3. To instill specialist skills in the administration of parallel and distributed clusters.

Semester:

Instructor (s):

Office Telephone: Email (s):

Intended Learning Outcomes (ILOs):

| A. Knowledge and Understanding | | NQF Descriptor/ Level |
|---|---|---|
| A1 | **Concepts and Theories:** Demonstrate critical knowledge understanding of concepts and techniques in parallel and distributed systems. | **Knowledge**: theoretical understanding [Level 9] |
| A2 | **Contemporary Trends, Problems and Research:** Recognize the current *and specialized* computing issues and research on emerging parallel and distributed systems technologies. | **Knowledge**: theoretical understanding [Level 9] |
| A3 | **Professional Responsibility: NA** | |

| B. Subject-specific Skills | | NQF Descriptor/ Level |
|---|---|---|
| B1 | **Problem Solving:** Identify complex real world problems related to parallel and distributed applications. | **Knowledge**: Practical Application [Level 9] **Skills**: Communication, ICT & Numeracy [Level 9] |
| B2 | **Modeling and Design:** Design innovative constructs in parallel and distributed systems. | Knowledge: Practical Application [Level 9] |
| B3 | **Application of Methods and Tools:** Apply specialist tools to develop and manipulate parallel and distributed applications. | Knowledge: Practical Application [Level 9] Skills: Communication, ICT & Numeracy [Level 9] |

| C. Critical-Thinking Skills | | NQF Descriptor/ Level |
|---|---|---|
| C1 | **Analytic skills:** Critically analyze the performance of various parallel and distrusted systems. | Generic Problem Solving & Analytical skills [Level 9] |
| C2 | **Synthetic: NA** | |
| C3 | **Creative Thinking and innovation:** Demonstrate professional level and creativity in providing effective and efficient solutions for the parallel and distributed paradigms. | Generic Problem Solving & Analytical skills [Level 9] |

| D. General and Transferable Skills (other skills relevant to employability and personal development) | | NQF Descriptor/ Level |
|---|---|---|
| D1 | **Communication:** Express and communicate ideas effectively, in written and oral form to their colleagues and/or Instructor, as appropriate. | Communication, ICT and Numeracy Skills [Level 9] |
| D2 | **Teamwork and Leadership:** Operate at professional level and work effectively as a member/leader of a team of technical people who may plan, design, implement, manage, monitor a project. | Competence: Autonomy, Responsibility and Context [Level 9] |

| D3 | **Organizational and Developmental Skills:** Engage in life-long learning and continuing self-development to hone professional and organizational skills. | Competence: Autonomy, Responsibility and Context [Level 9] |
|----|----|----|
| D4 | **Ethics and Social Responsibility: NA** | |

**Course Structure (Outline)**

| Course Structure (Outline) | | | | | | |
|---|---|---|---|---|---|---|
| **Week** | **Hours** | | **ILOs** | **Topics** | **Teaching Method** | **Assessment Method** |
| | **Lec.** | **Lab** | | | | |
| 1 | 3 | - | A1 | Introduction to Concurrent and parallel processes | Lecture | Oral Participation |
| 2 | 3 | - | A1 | Basic models of parallel computation | Lecture | Oral Participation |
| 3-4 | 6 | - | A1,B1, B2 | Parallel Algorithms: design and evaluation | Lecture/ Independent Learning | In-Class Exercises |
| 5-6 | 6 | - | A1, B1, B2, B3, C1, C3, D1, D3 | Parallel and distributed architecture and Middleware for Parallel Architecture | Lecture/ Case Studies/ Practical Demonstration | In-Class Exercises, **Assignment 1** |
| 7 | 3 | - | A1, B1, B2, B3, C1 | Message Passing Programming | Lecture/ Practical Demonstration | In-Class Exercises |
| 8-9 | 6 | - | A1, B1, B2, B3, C1 | Shared Memory Programming | Lecture/ Practical Demonstration | In-Class Exercises **Major Test** |
| 10 | 3 | - | A1, B1, B2, C1, D1 | Distributed Systems models | Lecture/ Case Studies | |
| 11-12 | 3 | - | A1, B1, B2, B3, C1, C3, D1, D3 | Grids and clusters | Lecture/Practical Demonstration | **Assignment 2** |

| 13-14 | 6 | - | A1, B1, C1 | Cyber Security in Parallel and distributed computing | Lecture, In-Class Exercises | |
|---|---|---|---|---|---|---|
| 15 | 3 | - | A1, A2, B1, B2, B3, C1, C3, D1, D2, D3 | Student Projects | Regulations and Procedures for the project | **Student Project Presentation** |
| 16 | 2 | | A1, B1, B2, C1, C3 | Final Exam | | |

**Teaching Materials:**

| | |
|---|---|
| **Textbook(s):** | 1. Zbigniew J. Czech, Introduction to Parallel Computing, Kindle Edition, 2017. ISBN: 978-1107174399. <br> 2. Dac-Nhouong Le et al., Cyber Security in Parallel and Distributed Computing: Concepts, Techniques, Applications and case studies, 1st Edition, Kindle Edition, John Wiley Publications, 2019. ISBN: 978-1119488057. <br> 3. Sukumar Ghosh, Distributed Systems: An Algorithmic Approach, 2nd Edition, Taylor and Francis Group, 2014. ISBN: 978-0367659127. |
| **Handout(s):** | Power point slides, http://www.ahlia.edu.bh/moodle. |
| **Reference(s):** | 1. Roman Trobec, Boštjan Slivnik, Patricio Bulić , Borut Robič ; Introduction to parallel computing: From algorithms to programming on state-of-the-art platforms, Springer, 2018. <br> 2. Ananth Grama, George Karypis, Vipin Kumar, Anshul Gupta. Introduction to Parallel Computing, 2nd Edition, Pearson, 2003. <br> 3. Janakiram D., Distributed and Object systems Lab, Tata McGraw-Hill, 2005. |

**Assessment**

| Method of Assessment | Description | Learning Outcomes | Weighting |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Assignments | The assignments consist of theoretical understanding, modelling, essay, problem solving and critical analysis of Parallel and distributed applications. Purpose of this assignment is to assess students where they have to demonstrate their extensive and detailed knowledge and critical awareness on emerging parallel processing, tools to design and critically evaluate the parallel – distributed architecture. This assignment will also assess students' skills in applying problem solving approaches to elicit and analyze requirements of middleware architecture in particular. Students will be asked (individually) to submit the assignment through the course page in Moodle where Turnitin will check answers against plagiarism. | A1, A2, B1, B2, B3, C1, C3, D1, D3 | 20% |
| Oral Participation | Students will be questioned orally to demonstrate their understanding and knowledge of the topics covered during class lectures and lab sessions. Feedback will be given to students to reaffirm their learning outcomes. | A1, D1 | Formative Assessment |
| In class Exercises | In-class exercises consist of problem solving and application of different tools and models to apply digital forensics techniques. | A1, B1, B2, B3 | Formative Assessment |
| Major Test | The midterm exam will be an in-class 1-hour exam that will consists of short-answer, essay, and problem solving questions and cover the topics studied in the first 8 weeks. | A1, B1, B2, C1, C3 | 20% |
| Team Research Project (Report and Presentation ) | Starting from week 4, the class will be divided into teams of 4-5 students where each team will be asked to study a research problem in parallel and distributed application development utilizing the knowledge, skills and tools learned in class. Teams are required to plan and execute the research project that must involve a main component of designing, coding, testing and deploying efficient parallel and distributed application. In the final week, each team will have to submit their research report (worth 15%) explaining the research problem, research methods used, analysis and the conclusion highlighting the research findings and results. The report must explain precisely the work accomplished by each | A1, A2, B1, B2, B3, C1, C3, D1, D2, D3 | 20% |

| | | | |
|---|---|---|---|
| | student. Each team will be required to make a presentation (worth 5%) summarizing the research conducted and its findings. Each team member has to participate in the presentation. Team-based work will be examined and evaluated as a whole as well as the individual work of each student. Team members will be tested individually during the presentation by peers and the instructor. | | |
| Final Exam | The final exam is comprehensive and will be of two hours duration. It will consist of short-answer, essay and problem-solving questions. Students will be asked to design and write the code of some components of mobile applications. | A1, B1, B2, C1, C3 | 40% |
| **Overall:** | | | **100 %** |

| Admissions | |
|---|---|
| **Pre-requisites** | None |
| **Minimum number of students** | 4 |
| **Maximum number of students** | 20 |

**COLLEGE OF INFORMATION TECHNOLOGY**
**DEPARTMENT OF INFORMATION TECHNOLOGY**

<u>**COURSE SYLLABUS/SPECIFICATION**</u>

| | |
|---|---|
| **CODE & TITLE:** | **ITCS 530: Bioinformatics Computing: (3-0-3)** |
| **WEIGHT:** | **(3-0-3)** |
| **PREREQUISITE:** | **Computer Programming skills** |
| **NQF Level Allocated:** | **5** |
| **NQF Notional Hours / Credits:** | **120** |
| **DESCRIPTION:** | Bioinformatics is the study of the structure and function of genes and proteins through the use of computational analysis, statistics, and pattern recognition and the use of databases, search and web-based interfaces to store, annotate and retrieve gene, protein and other information. This course focuses on the computing aspects of Bioinformatics. It introduces the broad frontiers of bioinformatics topics from fundamental algorithms to practical tools. Course topics include an overview of some bioinformatics resources, pattern matching, sequence alignment, gene prediction, fragment assembly, multiple alignment, phylogeny, statistical and machine learning approaches. |

**OBJECTIVES:**

1. To overview the biology of bioinformatics
2. To familiarize students with the principles and computational tools of contemporary bioinformatics
3. To discuss the bioinformatics techniques used in real scientific problems.
4. To learn about the algorithms and performance issues related to computational genomics.

| | |
|---|---|
| **SEMESTER:** | **ACADEMIC YEAR:** |
| **INSTRUCTOR:** | |
| **OFFICE TEL.:** | |
| **EMAIL:** | |

**INTENDED LEARNING OUTCOMES (ILOs)**

| A. | Knowledge and Understanding | NQF Descriptor/ Level |
|---|---|---|
| A1 | Concepts and Theories: Demonstrate critical understanding of concepts and theories of bioinformatics computing such as methods for storing, retrieving, organizing and analyzing biological data. | **Knowledge**: Theoretical understanding [Level 9] |
| A2 | Contemporary Trends, Problems and Research: Demonstrate an informed and critical awareness of constraints, motivation, and challenges presented to computational scientists by contemporary biological research problems. | **Knowledge**: Theoretical Understanding [Level 9] |
| A3 | Professional Responsibility: Demonstrate cognizance of, and adhere to the professional and legal standards of bioinformatics computing. | **Knowledge:** Theoretical Understanding. [Level 9] |

| B. | Subject-specific Skills | NQF Descriptor/ Level |
|---|---|---|
| B1 | Problem Solving: Demonstrate skills in formulating adequate computational solutions to real bioinformatics problems. | **Knowledge**: Practical application [Level 9] |
| B2 | Modeling and Design:  Design, implement and verify programs to investigate biological phenomena. | **Skills**: Generic problem solving & Analytical Skills [Level 9] **Knowledge**: Practical application [Level 9] |
| B3 | Application of Methods and Tools:  Use specific computational techniques and software tools such as MATLAB or bioinformatics software (e. g, BioPython) in the analysis of biological data. | **Skills**: Communication, ICT and Numeracy [Level 9] |

| C. | Thinking Skills | NQF Descriptor/ Level |
|---|---|---|
| C1 | Analytic: Analyze bioinformatics problems and propose suitable computational solutions. | **Skills**: Generic problem solving & Analytical Skills [Level 9] |
| C2 | Synthetic: Assemble and present problem outcomes in a clear and logical manner. | **Skills**: Generic problem solving & Analytical Skills [Level 9] |
| C3 | Creative: Identify and apply optimal computational solutions to given biological problems. | **Skills**: Informed judgements [Level 8] |

| D. | General and Transferable Skills (other skills relevant to employability and personal development) | NQF Descriptor/ Level |
|---|---|---|
| D1 | Communication: Express and communicate ideas cogently, persuasively and effectively in written and oral form. | **Skills**: Communication, ICT and Numeracy [Level 9] |
| D2 | Teamwork and Leadership: Work effectively as a member of a project team and demonstrate understanding of individual responsibility within the team. | **Competence**: Autonomy, Responsibility and Context [Level 9] |
| D3 | Organizational and Developmental Skills: Organize ideas and allocate time efficiently in assigned tasks. | **Competence**: Autonomy, Responsibility and Context [Level 8] |
| D4 | Ethical and Social Responsibility: Demonstrate understanding of, and adhere to, ethical and societal responsibilities in the field of bioinformatics computing. | **Knowledge**: Theoretical understanding [Level 9] |

## 11. Course Structure

| Week | Hours Lecture | Hours Lab | ILOs | Topics | Teaching Method | Assessment Method |
|---|---|---|---|---|---|---|
| 1 | 3 | - | A1, A2, A3 | Introduction to Bioinformatics. Overview of Biochemistry and Molecular Biology | Lecture Discussion | Oral Enquiry* (A1) |
| 2 | 3 | - | A1,A2, A3,D1,D4 | Introduction to the Genome, Information flow from the Genome , genes, DNA/RNA | Lecture Discussion | Oral Enquiry* (A1, D1) |
| 3 | 3 | - | A1, A2,A3,D1,D4 | Web-based information systems Assignment of Group Project | Lecture Discussion | Oral Enquiry* (A1,D1) Assignment 1 (A1, A2,A3,D1,D4) |
| 4 | 3 | - | A1, B1, B2, B3, C1, D1 | Bioinformatics programming and modeling Languages, Computational analysis tools Algorithms, Statistics, Hidden Markov models | Lecture Discussion Lab tutorial | Oral Enquiry* (A1,D1) |
| 5 | 3 | - | A1, B1,B2, B3,C1,D1 | Data Mining, Pattern matching techniques | Lecture, Discussion Lab tutorial | Oral Enquiry* (A1,D1) Assignement 2 (B1,B2,B3,C1,D1 ) |
| 6 | 3 | - | A1,B1,B2, B3,C1 | Databases and Data modeling, Search and Queries, Data warehouses | Lecture Lab tutorial | Oral Enquiry* (A1,D1) |
| 7 | 3 | - | A1,A2, A3, B1,B2, B3,C1,C2,D1 | Data visualization | Lecture Lab tutorial | Oral Enquiry* (A1,D1) Assignment 3 (B1,B2,B3,C1,D1) |
| 8-9 | 6 | - | A1, A2, B1, B2,C1,C2,D1 | Pairwise sequence Alignment BLAST and FASTA searching algorithms | Lecture | Midterm Exam (A1,B1,B2,C1,C2, D1) Oral Enquiry* (A1,D1) |
| 10 | 3 | - | A1, A2,B1,B2,B3,C1 ,D1 | Multiple sequence alignments algorithms | Lecture Discussion Lab tutorial | Oral Enquiry* (A1,D1) |
| 11 | 3 | - | A1,B1,B2,B3,D1 | Protein-protein interaction and networks, Hidden Markov model searches | Lecture Discussion | Oral Enquiry* (A1,D1) Assignement 4 (B1,B2,B3,D1) |
| 12 | 3 | - | A1, A2, A3, D1, D4 | Protein comparisons, domains and protein families, Gene prediction | Lecture Discussion | Oral Enquiry* (A1,A2,A3,D1,D4 ) |
| 13 | 3 | - | A1, A2, B1, B2, B3,C1,D1 | Genome sequencing and assembly Genome annotation: automated pipelines | Lecture Discussion Lab Tutorial | Oral Enquiry* (A1,D1) |
| 14 | 3 | - | A1, A2,B1, B2,B3, C1, C2,D1 | Genome annotation: manual Genome comparison | Lecture Discussion Lab Tutorial | Oral Enquiry* (A1,D1) |
| 15 | 3 | - | B1,B2, B3, C1,C2,C3, D1,D2, D3,D4 | Group Project Presentations by students | | Evaluation of Group Project (B1,B2,B3,C1,C2, C3,D1,D2,D3,D4) |
| 16 | 2 | | | **Comprehensive Assessment** | | **Final Exam** |

*FORMATIVE ASSESSMENT

3

**TEACHING MATERIAL:**

**TEXTBOOK(S):**      Miguel Rocha, Pedro G. Ferreira, Bioinformatics Algorithms: Design and Implementation in Python, 1st Edition, 1st edition, 2018, Academic Press

**HANDOUT(S):**      Lecture slides and notes
     Other resources are available on the Course website (Moodle system)

**REFERENCE(S):**
1. Paul M. Selzer, Richard J. Marhöfer, Oliver Koch, Applied Bioinformatics: An Introduction 2nd ed. 2018, Springer.
2. Chandra Sekhar Mukhopadhyay, Ratan Kumar Choudhary, Mir Asif Iquebal, Basic Applied Bioinformatics, 2017, Wiley Blackwell.
3. Charles Malkoff, Bioinformatics, Proteomics and Genomics, Callisto Reference, 2017.
4. David W. Mount, "Bioinformatics sequence and Genom Alanysis", Cold Spring Laboratory Press, 2016.
5. David J. Barnes, D. Chu, *Introduction to Modeling for Biosciences,* Springer, 2010
6. Larry Hunter , *The Processes of Life: An Introduction to Molecular Biology*, MIT Press, 2009
7. *Journal of Bioinformatics and Computational Biology,* Publisher: World Scientific, Imperial College Press.
8. *BMC Bioinformatics,* Publisher: Jo Appleford-Cook, BioMed Cenral
9. *BioData Mining,* Publisher: BioMed Cenral
10. *Cognitive Computation,* Publisher: Springer US
11. *Bioinformatics,* Publisher: Oxford University Press
12. More references are available in **the course website in Moodle.**

**ASSESSMENTS:**

| Type of Assessment[1] | Description[2] | Learning Outcomes[3] | Weighting |
|---|---|---|---|
| *Assignment 1* <br> *Assignment 2* <br> *Assignment 3* <br> *Assignment 4* | *Each assignment consists of a set of theoretical exercises related to the material covered in class (Assignment 1), in addition to programming questions where the student is required to write a program to implement bioinformatics algorithms discussed in class.* <br> *Assignments must be handed in electronically or uploaded on the Moodle system on the due date. The assignments will be made available on the course website on the Moodle system.* | Assignment 1: A1,A2,A3,D1 <br><br> Assignment 2 : B1,B2,B3,C1,D1 <br><br> Assignment 3 : B1,B2,B3,C1,D1 <br><br> Assignment 4 : B1,B2,B3,D1 | $4 \times 5\%$ |
| *Midterm Exam* | *The Midterm Exam is close book of one hour and 30 min duration, and consists of problem solving-based and short answer questions (SAQs).* | A1,B1,B2,B3,C1,C2 | 20 % |
| *Group Project evaluation* | *A project is assigned in the 3rd week of the semester where the students have to write a paper about one of the topics related to what is covered in the class. Students are recommended to contact the instructor to discuss any problems they may encounter.* <br> *In the final week, each student is required to make a presentation of his/her project. Presentations are* | B1,B2, B3, C1,C2,C3, D1,D2, D3,D4 | 15 % + 5% presentation |

| | | | |
|---|---|---|---|
| | *evaluated according to a specific marking rubric.* | | |
| *Final* *examination* | *The final exam is of two hours duration and consists of Multiple Choice Questions (MCQs) and problem solving-based short answer questions (SAQs) .* | A1, A3, B1,B2, C1,C2 | 40% |
| *Oral enquiry* | *Questions are asked continuously throughout the course to assess student understanding in the different topics covered in class.* | A1,A2,A3,D1 | Formative Assessment |
| | | **Overall:** | **100%** |

[1] *For approved types of assessment (e.g. quiz, exam, project, etc.) see the ILO-Assessment Matrix in page 9 of Assessment Manual Version 2.0*

[2] As *a minimum provide the description should provide details of type of tasks to be completed and duration (if appropriate)*

[3] *The learning outcomes should be taken from the weekly schedule. Ensure that the assessment type and the learning outcomes are aligned as per the ILO-Assessment Matrix in page 9 of Assessment Manual Version 2.0*

**COLLEGE OF INFORMATION TECHNOLOGY**

**DEPARTMENT OF INFORMATION TECHNOLOGY**

**COURSE SYLLABUS/ SPECIFICATION**

| | |
|---|---|
| **Course Code & Title:** | **ITCS 535 – Internet of Things (IoT)** |
| **Weight:** | **(3-0-3)** |
| **Prerequisite:** | **None** |
| **NQF Level Allocated:** | **9** |
| **NQF Notional Hours / Credits:** | **120 notional hours/ 12 NQF credit** |

**Description:** This course will provide students specialist theoretical and practical knowledge of Internet of Things (IoT), covering IoT systems architecture, hardware platforms, embedded programming and debugging, networking paradigms for IoT, secure operation, cloud integration, and simple data analytics. The course enables the students to design, implement, evaluate, document, and demonstrate an IoT prototypes.

**Objectives:**

1. To provide specialist knowledge and understanding of developing effective IoT applications using modern development tools.
2. To instill professional skills of applying various architecture and sensors to create adaptable IoT applications that can communicate smartly.
3. To equip students with the intelligent information management in complex IoT implementations and big data infrastructures.
4. To understand critical knowledge about complex security measures in IoT applications for effective continuation of the services.

**Semester:**

**Instructor (s):**

**Office Telephone:**                                **Email (s):**

**Intended Learning Outcomes (ILOs):**

| A. Knowledge and Understanding | | NQF Descriptor/ Level |
|---|---|---|
| A1 | **Concepts and Theories:** Understand extensive critical knowledge and understanding of concepts and techniques of developing IoT applications. | Knowledge: theoretical understanding [Level 9] |
| A2 | **Contemporary Trends, Problems and Research:** Recognize the current and specialized computing issues and research on emerging IoT technologies. | Knowledge: theoretical understanding [Level 9] |
| A3 | **Professional Responsibility: NA** | |
| **B. Subject-specific Skills** | | **NQF Descriptor/ Level** |
| B1 | **Problem Solving:** Identify complex problems associated with IoT applications in order to provide creative solutions. | Skills: Communication, ICT and Numeracy [Level 9] Knowledge: Practical Application [Level 9] |
| B2 | **Modeling and Design:** Apply specialized theories to design creative architecture of IoT applications that comprises of smart interfaces and its constituent components. | Knowledge: Practical Application [Level 9] |
| B3 | **Application of Methods and Tools:** Apply specialist tools to develop and manipulate IoT applications. | Skills: Communication, ICT and Numeracy [Level 9] Knowledge: Practical Application [Level 9] |

| C. Critical-Thinking Skills | | NQF Descriptor/ Level |
|---|---|---|
| C1 | **Analytic skills:** Critically analyse the performance and behavior of various components of IoT applications. | Generic Problem Solving and Analytical skills [Level 9] |
| C2 | **Synthetic:** Integrate multiple components of software/system for developing the enhanced IoT applications. | Generic Problem Solving and Analytical skills [Level 9] |
| C3 | **Creative Thinking and innovation: NA** | |

| D. General and Transferable Skills (other skills relevant to employability and personal development) | NQF Descriptor/ Level |
|---|---|

| | | | |
|---|---|---|---|
| **D1** | **Communication:** Express and communicate ideas effectively, in written and oral form to their colleagues and/or Instructor, as appropriate. | Communication, ICT and Numeracy Skills [Level 9] |
| **D2** | **Teamwork and Leadership:** Operate at professional level and work effectively as a member/leader of a team of technical people who may plan, design, implement, manage, monitor a project. | Competence: Autonomy & Responsibility [Level 9] |
| **D3** | **Organizational and Developmental Skills:** Engage in life-long learning and continuing self-development to hone professional and organizational skills. Assimilate effective work habits including but not limited to time management. | Competence: Autonomy & Responsibility [Level 9] |
| **D4** | **Ethics and Social Responsibility:** NA | |

## Course Structure (Outline)

<table>
<tr><th colspan="7">Course Structure (Outline)</th></tr>
<tr><th rowspan="2">Week</th><th colspan="2">Hours</th><th rowspan="2">ILOs</th><th rowspan="2">Topics</th><th rowspan="2">Teaching Method</th><th rowspan="2">Assessment Method</th></tr>
<tr><th>Lec.</th><th>Lab</th></tr>
<tr>
<td>1</td><td>3</td><td>-</td><td>A1</td>
<td>• Internet of Things (IoT) Introduction<br>• Perspectives and impact</td>
<td>Lecture</td><td>-</td>
</tr>
<tr>
<td>2</td><td>3</td><td>-</td><td>A1</td>
<td>**Technological evolution of IoT**<br>• IoT and SCADA<br>• IoT and M2M<br>• IoT and Big Data<br>• IoT Standards<br>• Standards in practice<br>• Operating Platforms and systems</td>
<td>Lecture/Class Discussion</td><td>-</td>
</tr>
<tr>
<td>3</td><td>3</td><td>-</td><td>A1, A2, B1, B2</td>
<td>**IoT architectures**<br>• Architectural Overview– Building an architecture<br>• Main design principles and needed capabilities<br>• IoT architecture outline<br>• Standards considerations<br>• M2M and IoT Technology Business processes in IoT<br>• Everything as a Service (XaaS)</td>
<td>Lecture/ Case Studies</td><td>Oral Participation</td>
</tr>
</table>

| | | | | | | |
|---|---|---|---|---|---|---|
| 4 | 3 | - | A1, B1, B2, B3, C1, C2 | **IoT architectures**<br>• IoT Architecture-State of the Art<br>• Reference Model and architecture<br>• Functional View<br>• Information View<br>• Deployment and Operational View<br>• Integrating Could with IoT<br>• Real-World Design Constraints<br>• Data representation and visualization, Interaction and remote control. | Lecture/ Practical Demonstration | In-Class Exercises |
| 5 | 3 | - | A1, B1, C1, C2, D1 | **Sensor and actuator interfacing**<br>• Data acquisition<br>• Design and testing Digital Signals<br>• Interfacing Elements : PINS & Values<br>• Industrial sensors – Description & Characteristics<br>• Integrated IoT Sensors – Description & Characteristics | Lecture/ Class Discussion | Oral Participation |
| 6 | 3 | - | A1, B1, B2, C1, D1, D3 | **Wireless sensor networks & Ad-hoc networks**<br>• Node architecture- sensing subsystem<br>• Wireless Transmission Technology and systems-Radio Technology | Lecture/ Case Studies/ Class Discussion | **Assignment 1** |
| 7 | 3 | - | A1, B1, D1 | **Wireless sensor networks & Ad-hoc networks**<br>• IOT Data Link Layer & Network Layer Protocols<br>• Transport & Session Layer Protocols | Lecture/ Class Discussion | Oral Participation |

| | | | | | | |
|---|---|---|---|---|---|---|
| 8 | 3 | - | A1, A2, B1, B3 | • **Intelligent Information Processing**<br>• Big Data Platforms For The Internet Of Things<br>• Fog Computing | Lecture/ Practical Demonstration | **Major Exam** |
| 9 | 3 | - | A1, B1, B3 | • **Intelligent information processing**<br>• Sustainability Data And Analytics | Lecture/ Practical Demonstration | In-class Exercices |
| 10 | 3 | - | A1, B1, B2, B3, C1 | • **IoT Application Design**<br>• Components Of IoT System<br>• Web Enhanced Building<br>• Creating Webapp For IoT<br>• Case Study For IoT Service | Lecture/ Case Studies | In-Class Exercises |
| 11 | 3 | - | A2, B1, B2, C1, C2, D1, D3 | • **IoT application design**<br>• Sensor Controlled Home Automation<br>• Smart Cities | Lecture/ Case Studies | In-Class Exercises/ **Assignment 2** |
| 12 | 3 | - | B2, B3, C1, C2 | • **IoT application design**<br>• Prototype of IOT Applications (Case Studies) | Lecture/ Practical Demonstration | In-Class Exercises |
| 13-14 | 6 | - | A1, A2, B1, C1, C2 | **Security In IoT**<br>• Service Layer Protocols & Security<br>• Middleware And Security Issues<br>• RFID False Authentications<br>• Automatic Control<br>• Fault Modeling And Simulation | Lecture/ Case Studies | Oral Participation |
| 15 | 3 | - | A2, B1, B2, B3, C1, C2, D1, D2, D3 | **Project** | Student presentations | Evaluation of **Project Presentations & Reports** |
| 16 | 2 | - | A1, B1, B2, C1, C2 | **Final Examination** | | |

**Teaching Materials:**

| Textbook(s): | 1. Perry Lea, Internet of Things for Architects: Architecting IoT solutions by implementing sensors, communication infrastructure, edge computing, analytics, and security, 2018, Packt Publishing, ISBN: 978-1788470599.<br>2. V.K. Sachan, Internet of Things (IoT) & Its Applications: A Complete Guide on Python Programing for IoT with Practical Exercises for Learners, 1st Kindle Edition, 2020. |
|---|---|
| Handout(s): | Power point slides,  http://www.ahlia.edu.bh/moodle. |
| Reference(s): | 1. Mehmet Yildiz, A Practical Guide for IoT Solution Architects: Architecting secure, agile, economical, highly available, well performing IoT ecosystems (Internet of Things - IoT Architecture), Independently published, 2019, ISBN-13: 978-1080722969.<br>2. Oscar Bexell, Things you should know about the Internet of Things: Technologies, use cases, projects and strategies, 2020, Bexell and Bwireless.<br>3. Vlasios Tsiatsis et. al, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 2014, 1st Edition, Academic Press Inc, ISBN-13: 978-0124076846. |

**Assessment**

| Method of Assessment | Description | Learning Outcomes | Weighting |
|---|---|---|---|
| Assignments | Two assignments, each worth 10%, consist of essay, problem-solving and research based theoretical questions. The purpose of the assignments is to assess students individually where they have to demonstrate their extensive and detailed knowledge and critical awareness of current research, trends and advancements in IoT applications. The assignments will also assess students' skills in critically evaluating the design, implementation and deployment of efficient and interactive IoT applications by discovering through research. Soft copy submission is required through the course page in Moodle where | A2, B1, B2, C1, D1, D3 | 20% |

| | | | |
|---|---|---|---|
| | answers will be checked by Turnitin against plagiarism. | | |
| Oral Participation | Students will be questioned orally to demonstrate their understanding and knowledge of the topics covered during class lectures. Feedback will be given to students to reaffirm their learning outcomes. | A1, D1 | Formative |
| In class Exercises | In-class exercises consist of problem solving and application of different tools and models in providing IOT solutions. | B1, B3 | Formative Assessment |
| Major Exam | The major exam will be an in-class 1-hour exam that will consists of short-answer, essay, and problem solving questions and cover the topics studied in the first 7 weeks. Students will be asked to design and write the code of some components of mobile applications. | A1, B1, B2, C1 | 20% |
| Project | Starting from weak 4, the class will be divided into teams of 4-5 students where each team will be asked to study a research problem in IoT using published research articles. Teams are required to plan and execute the project that must involve a main components of designing, coding, testing and deploying efficient and interactive IoT applications for real life domains. In the final week, each team will have to submit their report (worth 8%) explaining the problem, objectives, methods used, solution and the conclusion highlighting the findings and results. The report must explain precisely the work accomplished by each student. Each team will be required to make a presentation (worth 5%) summarizing the work conducted and its findings. Moreover, working prototype will have to be demonstrated (worth 8%). Each team member has to participate in the presentation. Team-based work will be examined and evaluated as a whole as well as the individual work of each student. Team members will be tested individually during the presentation by peers and the instructor. | A2, B1, B2, B3, C1, C2, D1, D2, D3 | 20% |
| Final Exam | The final exam is comprehensive and will be of two hours duration. It will consist of short-answer, essay and problem-solving questions. Students will be asked to model and integrate some components of IoT applications. | A1, B1, B2, C1, C2 | 40% |
| **Overall:** | | | **100 %** |

## Admissions

| Pre-requisites | None |
|---|---|
| Minimum number of students | 4 |
| Maximum number of students | 20 |

**COLLEGE OF INFORMATION TECHNOLOGY**

**DEPARTMENT OF INFORMATION TECHNOLOGY**

**COURSE SYLLABUS/ SPECIFICATION**

**Course Code & Title:**    **Machine Learning**/ ITCS 538

**Weight:**    **(3 - 0 - 3)**

**Prerequisite:**    NONE

**NQF Level Allocated:**    Level 9

**NQF Notional Hours / Credits:** 120 notional hours/ 12 NQF credit

**Description:** This is an advanced course on machine learning, focusing on recent advances in machine learning algorithms in different learning types, such as supervised, unsupervised and reinforcement. The course covers advanced machine learning algorithms and techniques, such as neural networks, classification of data, automatic regression and unsupervised model fitting. Applications are, for example, image and speech analysis, medical imaging, and exploratory data analysis in natural science and engineering.

**Objective:**

1. To obtain in depth knowledge of machine learning techniques and skills.
2. To understand machine learning algorithms for solving real-world problems.
3. To compare and evaluate various machine learning algorithms and models.
4. To grasp the open issues and trends in machine learning research.
5. To learn how to represent big amounts of data and reduce the dimensionality in order to cluster or classify your data efficiently.

SEMESTER:

INSTRUCTOR:
OFFICE TEL:
EMAIL:

**Intended Learning Outcomes (ILOs):**

| A. Knowledge and Understanding | | NQF Descriptor/ Level |
|---|---|---|
| A1 | **Concepts and Theories:** Demonstrate knowledge and critical understanding of core concepts and theories of machine learning. | Knowledge: theoretical understanding [Level 9] |
| A2 | **Contemporary Trends, Problems and Research:** Demonstrate critical awareness of real-world problems, research issues and technological advancements in the field of machine learning. | Knowledge: theoretical understanding [Level 9] |
| A3 | *Professional Responsibility: N/A* | |

| B. Subject-specific Skills | | NQF Descriptor/ Level |
|---|---|---|
| B1 | **Problem Solving:** Identify complex problems and provide relevant specialized solutions using various machine learning techniques. . | Communication, ICT and Numeracy Skills [Level 9] Knowledge: Practical application [Level 9] |
| B2 | **Modeling and Design:** Design components needed to produce machine learning models to meet desired needs within realistic constraints. | Knowledge: Practical application [Level 9] |
| B3 | **Application of Methods and Tools:** Apply specialist techniques and tools to develop creative machine learning models. | Knowledge: Practical application [Level 9] Skills: Communication, ICT and Numeracy [Level 9] |
| C. Critical-Thinking Skills | | NQF Descriptor/ Level |
| C1 | **Analytic skills:** Critically analyze machine learning techniques in given problems in order to test the performance of the resulting software/system. | Generic Problem Solving & Analytical skills [Level 9] |
| C2 | *Synthetic: NA* | |
| C3 | **Creative Thinking and innovation:** Create efficient and effective techniques for real world machine learning systems. | Generic Problem Solving & Analytical skills [Level 9] Competence: Autonomy, Responsibility and Context [Level 9] |

| D. General and Transferable Skills (other skills relevant to employability and personal development) | NQF Descriptor/ Level |
|---|---|

| D1 | **Communication:** Express and communicate ideas cogently, persuasively, and effectively, in written and oral form, to a diverse range of audiences. | Communication, ICT and Numeracy Skills [Level 9] Knowledge: Practical application [Level 9] |
|---|---|---|
| D2 | **Teamwork and Leadership:** Operate at a professional level and work effectively as a member/leader of a team in order to complete a pre-defined research project. | Competence: Autonomy, Responsibility and Context [Level 8] |
| D3 | *Organizational and Developmental Skills: N/A* | |
| D4 | *Ethics and Social Responsibility: N/A* | |

## Course Structure (Outline)

| Course Structure (Outline) | | | | | | |
|---|---|---|---|---|---|---|
| **Week** | **Hours** | | **ILOs** | **Topics** | **Teaching Method** | **Assessment Method** |
| | **Lec.** | **Lab** | | | | |
| 1 | 3 | - | A1 | **Introduction:**<br>- Machine learning systems<br>- Problems that machine learning can solve | Lecture/ Class Discussion | - |
| 2 | 3 | - | A1, D1 | **Classification and training models:**<br>- Multiclass, Multilabel and Multioutput classification<br>- Linear, Polynomial and Logistic Regression | Lecture/ Exercises | Oral Participation |
| 3 | 3 | - | A1, A2, B1,B2,C1 | **Supervised Learning:**<br>– Classification and Regression<br>– Generalization, Overfitting and Underfitting | Lecture/ In-class Exercises/ Independent Learning | In-class Exercises |
| 4-5 | 6 | - | A1 ,B2, B3, C1 | **Supervised Machine Learning Algorithms:**<br>- K-Nearest Neighbor<br>- Linear Model.<br>- Naïve Bayes Classifier.<br>- Decision Tree | Lecture/ practical Demonstration | Oral Participation/ In-class Exercises |
| 6-7 | 6 | - | A1, A2, B1, B2, B3, C1, C3, D1 | **Neural Network and Deep learning:**<br>- Conventional Neural Network<br>- Recurrent Neural Network | Lecture/ In-class Exercises | Assignment1/ In-class Exercises |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8 | 3 | - | A2, B2, B3, C1, C3 | **Training Deep Neural Nets** | Lecture/ Independent Learning/ practical Demonstration | In-class Exercises |
| 9 | 3 | - | A1,B1,B2, C1 | **Dimensionality reduction, Feature Extraction and Manifold learning** | Lecture | Major Exam |
| 10-11 | 6 | - | A1, A2, B1, B2, B3, C1 | **Unsupervised machine learning:**<br>- Clustering Models<br>- K-Means clustering algorithm | Lecture/ Independent Learning/ Practical Demonstration | In-class Exercises<br><br>Oral Participation |
| 12 | 3 | - | A1, B1, B2, ,C1 | **Reinforcement learning:**<br>- Learning to optimize rewards.<br>- Markov Decision process | Lecture/ Discussion | Oral Participation |
| 13 | 3 | - | A1, A2, B1, B2, B3, C1, D1 | **Model Evaluation and Improvement:**<br>- Confusion Metrix.<br>- Recall and Precision<br>- Recall/Precision trad-off<br>- Error Analysis<br>- Cross-validation | Lecture/ In-class Exercises/ Practical Demonstration | Assignment2/ In-class Exercises |
| 14 | 3 | - | A1, B1,B2, B3, C1, C3 | **Dealing with real world data:**<br>- Data representation.<br>- Scaling the data with TFIDF | Lecture/ In-class Exercises/ Practical Demonstration | In-class Exercise |
| 15 | 3 | - | A2,B1,B2,B3,C1, C3, D1, D2 | Students team research projects (reports and presentations) | Student presentations of research projects | **Evaluation of Research Project Outcome & Presentation** |
| 16 | 2 | - | A1,B1, B2,C1, C3 | Final Exam | | |

**Teaching Materials:**

| | |
|---|---|
| **Textbook(s):** | 1. Géron, A., 2019. *Hands-on machine learning with Scikit-Learn, Keras, and TensorFlow: Concepts, tools, and techniques to build intelligent systems.* O'Reilly Media.<br>2. Müller, A.C. and Guido, S., 2016. *Introduction to machine learning with Python: a guide for data scientists.* " O'Reilly Media, Inc.". |
| **Handout(s):** | PowerPoint slides available on Moodle i.e. http://www.ahlia.edu.bh/moodle |
| **Reference(s):** | 1. Bell, J., 2020. *Machine learning: hands-on for developers and technical professionals.* John Wiley & Sons.<br>2. Jain, V. and Chatterjee, J.M. eds., 2020. *Machine Learning with Health Care Perspective: Machine Learning and Healthcare* (Vol. 13). Springer Nature.<br>3. Das, S.K., Das, S.P., Dey, N. and Hassanien, A.E., 2020. Machine Learning Algorithms for Industrial Applications.Sipringer.<br>4. Neapolitan, Richard E., and Xia Jiang. *Artificial Intelligence: With an Introduction to Machine Learning.* CRC Press, 2018.<br>5. Goodfellow, Ian, et al. Deep learning. Vol. 1. Cambridge: MIT press, 2016.<br>6. Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, Prentice Hall, 3rd edition, 2016. |

**Assessment**

| Type of Assessment | Description | ILOs | Weighting |
|---|---|---|---|
| Assignments | Two assignments and each worth 10%. The purpose of the assignments is to assess students individually where they have to demonstrate their extensive and detailed knowledge and critical understanding of key concepts, theories, methods, tools and techniques of machine learning. The assignments will also assess students' skills to solve and analyze real-world problems using advanced techniques, methods and tools. Soft copy submission is required through the course page in Moodle where answers will be checked by Turnitin against plagiarism. | A2, B1, B2, B3, C1, D1 | 20% |

| | | | |
|---|---|---|---|
| In- Class Exercises | In-class exercises consist of problem solving and application of different tools. Each exercise will be one hour duration. | B1,B2,C1 | Formative Assessment |
| Oral participation | Students will be questioned orally to demonstrate their understanding and knowledge of the topics covered during class lectures. Feedback will be given to students to reaffirm their learning outcomes. | A1, D1 | Formative Assessment |
| Major Exam | The midterm exam will be an in-class 2-hours exam that will consists of short-answer, essay, and problem solving questions and cover the topics studied in the first 8 weeks. | A1,B1, B2, C1 | 20% |
| Project Report and Presentation | Starting from weak 4, the class will be divided into teams of 4-5 students and each will be asked to study a research problem in machine learning utilizing the skills and tools learned in class. Teams are required to plan and execute the research project that may involve the application of advanced techniques and tools to develop efficient machine learning system .In the final week, each team will have to submit their research report (worth 14%) explaining the research problem, research methods used, analysis and the conclusion highlighting the research findings and results. The report must explain precisely the work accomplished by each student. Each team will be required to make a presentation (worth 6%) summarizing the research conducted and its findings. Each team member has to participate in the presentation. Team-based work will be examined and evaluated as well as the individual work of each student. Team members will be tested individually during the presentation by peers and the instructor. | A2,B1, B2,B3,C1, C3, D1, D2 | 20% |
| Final Exam | The final exam is comprehensive and will be of two hours duration. It will consist of short-answer, essay and problem-solving questions in machine learning. | A1,B1, B2,C1, C3 | 40% |
| | | Overall | 100% |

| Admissions | |
|---|---|
| Pre-requisites | NONE |
| Minimum number of students | 4 |
| Maximum number of students | 25 |

**COLLEGE OF INFORMATION TECHNOLOGY**

**DEPARTMENT OF IT**

<u>**COURSE SYLLABUS/ SPECIFICATION**</u>

**Course Code & Title:**      **ITCS 539 – Digital Forensics**

**Weight:**      **(3-0-3)**

**Prerequisite:**      **None**

**NQF Level Allocated:**      **9**

**NQF Notional Hours / Credits:**    **120 notional hours/ 12 NQF credit**

**Description:** This course involves the investigation of computer-related crimes with the goal of obtaining evidence to be presented in a court of law. It will help the students to learn the principles and techniques for digital forensics investigation and the spectrum of available computer forensics tools. It emphasizes the core forensics procedures to ensure court admissibility of evidence, as well as the legal and ethical implications. In addition, students will learn the forensic investigation on operating systems with different file systems, forensic procedures, review and analyze forensics reports.

## Objectives:

1. To critically explore various digital forensics principles, standards and procedures
2. To understand the scientifically derived and proven methods towards the digital events found to be criminal
3. To explain the digital forensics on internet with advanced analytics from various sources (open sources, personal email and cloud).
4. To apply a range of specialist models and methods in mobile devices and embedded systems.
5. To research current trends and challenges in field of digital forensics with an emphasis on computational forensics.

**Semester:**

**Instructor (s):**

**Office Telephone:**                **Email (s):**

**Intended Learning Outcomes (ILOs):**

| A. Knowledge and Understanding | | NQF Descriptor/ Level |
|---|---|---|
| A1 | **Concepts and Theories:** Demonstrate critical knowledge and understanding of specialized theories, principles and concepts of digital forensics and artifacts. | Knowledge: Theoretical understanding [Level 9] |
| A2 | **Contemporary Trends, Problems and Research:** Demonstrate critical awareness of the current research, trends, advancements and challenges in digital forensics. | Knowledge: theoretical understanding [Level 9] |
| A3 | **Professional Responsibility: NA** | |
| **B. Subject-specific Skills** | | **NQF Descriptor/ Level** |
| B1 | **Problem Solving:** Identify complex and real world problems related to cybercrimes in order to provide model solutions. | Knowledge: Practical Application [Level 9] Skills: Communication, ICT & Numeracy [Level 9] |
| B2 | **Modeling and Design:** Model real time systems to address the disk structures, mobile and embedded forensics. | Knowledge: Practical Application [Level 9] |
| B3 | **Application of Methods and Tools:** Use effectively specialized tools to implement various methods related to Digital forensics | Knowledge: Practical Application [Level 9] Skills: Communication, ICT & Numeracy [Level 9] |
| **C. Critical-Thinking Skills** | | **NQF Descriptor/ Level** |
| C1 | **Analytic skills:** Critically analyze the performance of the digital forensic techniques**.** | Generic Problem Solving & Analytical skills [Level 9] |
| C2 | **Synthetic: NA** | |
| C3 | **Creative:** Demonstrate professional level and creative methods pertaining to cybercrimes in complex situations. | Generic Problem Solving & Analytical skills [Level 9] Competence: Autonomy, Responsibility and Context [Level 9] |
| **D. General and Transferable Skills (other skills relevant to employability and personal development)** | | **NQF Descriptor/ Level** |
| D1 | **Communication:** Develop an ability to effectively communicate through presentations skills on timeline analysis, executive summaries in project report writing and oral presentation. | Skills: Communication, ICT and Numeracy [Level 8] |
| D2 | **Teamwork and Leadership:** Operate at professional level and work effectively as a member of a project team. | Competence: Autonomy, Responsibility and Context [Level 9] |
| D3 | **Organizational and Developmental Skills:** NA | |

| D4 | **Ethics and Social Responsibility:** Demonstrate awareness of, and adhere to, ethical and societal responsibilities in the area of digital forensics. | Competence: Autonomy, Responsibility and Context [Level 9] |

## Course Structure (Outline)

| Week | Hours | | ILOs | Topics | Teaching Method | Assessment Method |
|------|-------|-----|------|--------|-----------------|-------------------|
|      | Lec.  | Lab |      |        |                 |                   |
| 1 | 3 | - | A1 | Course overview,<br><br>**Introduction**<br>Forensic Science<br>Digital Forensics<br>Digital Evidences | Lecture/ Class Discussion | Oral Participation |
| 2 | 3 | - | A1 | **Digital Forensics Process**:<br>Introduction<br>Identification Phase<br>Collection Phase<br>Examination Phase<br>Analysis Phase<br>Presentation Phase | Lecture/ Class Discussion | Oral Participation |
| 3 | 3 | - | A1, A2, D1, D4 | **Cybercrime Law**<br>Introduction<br>International Legal Framework<br>Digital Crime | Lecture/<br><br>Independent Learning | **Assignment 1 (Literature reviews)** |
| 4 | 3 | - | A1, B1 | **Cybercrime Law**<br>Investigation methods for collecting digital crime<br><br>International co-operation to collect digital evidence | Lecture/ Class Discussion | Oral Participation |
| 5 | 3 | - | A1, B1 | **Digital forensic readiness**<br>Introduction<br>Definition<br>Law enforcement Vs Digital Forensics readiness | Lecture/ In class exercises/ Case Studies | In-Class Exercises |
| 6 | 3 | - | B1, B2, B3 | A rationale for Digital forensic readiness<br><br>Frameworks, Standards and Methodologies | Lecture/ Practical demonstration | In-Class Exercises |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Becoming Digital Forensic Ready<br><br>Enterprise Digital Forensic Readiness | | |
| 7 | 3 | - | A1, B1, B2, B3, C1 | **Computer Forensics:**<br>Introduction<br>Evidence Collection<br>Examination<br>  Physical<br>  Logical data structure<br>File System<br>  NTFS, INSX,<br>  Orphan, ETX2/3/4<br>  Operating system<br>  Artifacts<br>  Linux distribution<br>Analysis<br>  Analysis tools<br>  Timeline analysis<br>  File Hashing<br>  Filtering,<br>  Data carving | Lecture/ Practical demonstration/ Class Discussion | Case studies/ In – Class exercises<br><br>Oral Participation |
| 8-9 | 6 | - | A1, B1, B2, B3, C1, C3 | **Mobile and Embedded Forensics:**<br><br>Introduction<br><br>Embedded Systems and consumer electronics<br><br>Mobile Phones<br><br>Telecommunication Networks<br><br>Mobile devices and Embedded systems as Evidence<br><br>Malware security considerations<br><br>Ontologies for Mobile and Embedded forensics | Lecture/ Practical demonstration / Class Discussion | Case Study/ In –Class exercises<br><br>**Major Exam** |

| 10-11 | 6 | - | B1, B2, B3, C1 | **Collection Phase** <br><br> Special consideration for Embedded systems and Mobile devices <br><br> Handling Electronics <br><br> First Contacts <br><br> Physical Acquisition <br><br> Logical Acquisition of data <br><br> **Examination Phase** <br><br> Top-down flash translation layer <br><br> Top-down flash file systems <br><br> Bottom up carving <br><br> Bottom up keyword search <br><br> Technical deep drive | Lecture/ Practical demonstration/ In-class exercises | In-Class Exercises |
|---|---|---|---|---|---|---|
| 12 | 3 | - | A1, A2, C1, B1, B2, B3 | **Reverse Engineering and analysis of applications** <br><br> Methods <br><br> Black box testing <br><br> Static code analysis <br><br> Runtime analysis <br><br> Targets <br><br> Program functionality <br><br> Data structures <br><br> Protocols <br><br> Encryption | Lecture/ Case study | In-class Exercises |

| | | | | | | |
|---|---|---|---|---|---|---|
| 13 | 3 | - | A1, C1, B3 | **Internet Forensics:**<br><br>Introduction<br><br>Computer Networking<br><br>Layers of network abstraction<br><br>The Internet backbone<br><br>Collection Phase - Network Acquisition<br><br>Collection Phase - Remote Acquisition<br><br>   Server<br><br>   Cloud services<br><br>   Open sources | Lecture/ Practical demonstration | In-class exercises |
| 14 | 3 | - | A2, C1, D1, D4 | **Challenges in Digital Forensics:**<br><br>Computational forensics<br><br>Disciplines of Computational forensics<br><br>Automation and standardization<br><br>Research Agenda | Lecture/ Independent Learning | Assignment 2 |
| 15 | 3 | - | A2, B1,B2, B3, C1, C3, D1, D2, D4 | Student Team Project Presentations | Regulations and Procedures for the project | **Student Project Presentation** |
| 16 | 2 | - | A1,B1,B2, C1,C3 | **Final Exam** | | |

**Teaching Materials:**

| | |
|---|---|
| **Textbook(s):** | 1. Andre Arnes, Digital Forensics 1$^{st}$ Edition, John Wiley & Sons, 2018. ISBN: 9781119262381. |
| **Handout(s):** | Lecture Notes and Case Studies |
| **Reference(s):** | 1. John Sammons, The Basics of Digital Forensics, 2$^{nd}$ Edition, SYNGRESS, 2014, ISBN: 978-0128016350.<br><br>2. Cory Altheide, Harlan Carvey; Digital Forensics with Open Source Tools, 1$^{st}$ Edition, 2011, ISBN: 9781597495868.<br><br>3. Thomas A. Johnson, Forensic Computer Crime Investigation, 1$^{st}$ Edition, CRC Press, 2005, ISBN: 978-0824724351 |

**Assessment**

| Method of Assessment | Description | Learning Outcomes | Weighting |
|---|---|---|---|
| **Major Exam** | The major exam will be an in-class 90 minutes exam that will consists of short-answer, essay, and problem solving questions, and cover the topics studied in the first 9 weeks. | A1, B1, B2, C1 | 20% |
| **Assignments** | The assignments consist of essay, problem-solving and literature review. The purpose of the assignments is to assess students where they have to demonstrate their extensive and detailed knowledge and critical awareness of current research, trends and advancements in Digital forensics techniques. The assignments will also assess students' skills in applying problem solving approaches to elicit and analyze requirements of Digital forensics. Soft copy submission is required through the course page in Moodle where answers will be checked by Turnitin against plagiarism. | A2, C1, B1, B2, B3, D1, D4 | (10% + 10% =) 20% |
| **In class Exercises** | In-class exercises consist of problem solving and application of different tools and models to apply digital forensics techniques. | B1,B2, B3 | Formative Assessment |
| **Oral Participation** | Students will be questioned orally to demonstrate their understanding and knowledge of the topics covered during class lectures and lab sessions. Feedback will be given to students to reaffirm their learning outcomes. | A1, B1, D1 | Formative Assessment |
| **Project** | Student teams will propose and develop a medium-sized project of their own. Soft copy submission is required through the course page in Moodle where the project report will be checked by Turnitin against plagiarism. | A2, B1,B2, B3, C1, C3, D1, D2, D4 | 20% |
| **Final Exam** | The final exam is comprehensive and will be of two hours duration. It will consist of short-answer, essay and problem-solving questions. | A1,B1,B2, C1,C3 | 40% |
| **Overall:** | | | **100 %** |

| Admissions | |
|---|---|
| Pre-requisites | None |
| Minimum number of students | 4 |
| Maximum number of students | 25 |

**Ahlia University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see** www.ahlia.edu.bh/integrity **for more information).**

COLLEGE OF INFORMATION TECHNOLOGY

DEPARTMENT OF IT

<u>COURSE SYLLABUS/ SPECIFICATION</u>

Course Code & Title:     **ITCS 550 – Research Methods and Modeling**

Weight:                  **(3-0-3)**

Prerequisite:            **Successful completion of at least 9 credits**

NQF Level Allocated:     **9**

NQF Notional Hours / Credits:   **120 notional hours/ 12 NQF credit**

**Description:** The course provides knowledge and skills in useful qualitative and quantitative research methods with the aim of enabling Master students to carry out their independent research and to execute and plan their research projects in IT and Computer Science. Particular focus of the course is to enable students to independently do literature review, to formulate their research problem, to conceptualize their research design and to write their final report. It also familiarizes students with Ahlia University guidelines for Master dissertation.

**Objective:**

1. To introduce various types of research techniques in IT and Computer Science

2. To explain how to formulate a research problem and conceptualize an appropriate research design

3. To demonstrate how to apply research ethics including perils of plagiarism and importance of acknowledging other people's work and proper way of referencing

4. To explain various qualitative and quantitative research methods used in IT and Computer Science

5. To encourage students to develop their independent research proposals.

6. To encourage students to conduct independent research in the field of IT and Computer Science

**Semester:**

**Instructor (s):**

**Office Telephone:**    **EXT:**                          **Email (s):**

## Intended Learning Outcomes (ILOs):

| A. Knowledge and Understanding | | NQF Descriptor/ Level |
|---|---|---|
| A1 | **Concepts and Theories:** Demonstrate knowledge and understanding of concepts and theories of quantitative and qualitative research methods as applied in Information Technology (IT) and Computer Science. | Knowledge: theoretical understanding [Level 9] |
| A2 | **Contemporary Trends, Problems and Research:** Understand contemporary trends and best practices of research in the field of Information Technology (IT) and Computer Science. | Knowledge: theoretical understanding [Level 9] |
| A3 | **Professional Responsibility:** Demonstrate cognizance of, and adhere to, the professional and legal standards of research in IT and Computer Science and develop continuing awareness of best practices used in the production and publication of research work in these areas. | Knowledge: theoretical understanding [Level 9] |

| B. Subject-specific Skills | | NQF Descriptor/ Level |
|---|---|---|
| B1 | **Problem Solving:** Solve quantitative problems encountered in IT and Computer Science research (formulating/testing hypos). | Knowledge: Practical Application [Level 9] Skills: Communication, ICT & Numeracy [Level 9] |
| B2 | **Modeling and Design:** Conceptualize and apply qualitative and quantitative research designs in IT and Computer science. | Generic problem solving and analytical skills [Level 9] Knowledge-Practical application [level 9] |
| B3 | **Application of Methods and Tools:** Employ methods of data gathering and apply tools (software) applicable to and encountered in practical problems of research in various areas of interest. | Generic problem solving and analytical skills [Level 9] |

| | | Knowledge – Practical application [Level 9] Communication, ICT and Numeracy Skills [Level 9] |
|---|---|---|

| C. Critical-Thinking Skills | | NQF Descriptor/ Level |
|---|---|---|
| **C1** | **Analytic skills:** Evaluate real world research problems in conceptual terms; identify the appropriate research and computational methods (input) needed to solve them and analyze the output accordingly generated using quantitative or qualitative techniques. | Generic problem solving and analytical skills [Level 9] |
| **C2** | **Synthetic:** Integrate various research findings to generate coherent conclusions and recommendations to achieve long-term objectives and demonstrate the complex issues and problems in Information Technology (IT) and Computer Science. | Generic problem solving and analytical skills [Level 9] |
| **C3** | **Creative:** Utilize outcomes of research to generate new and novel research questions in the field of IT and computer science. | Generic problem solving and analytical skills [Level 9] Competence: |

| D. General and Transferable Skills (other skills relevant to employability and personal development) | | NQF Descriptor/ Level |
|---|---|---|
| **D1** | **Communication:** Effectively communicate in written and oral form, and using technical and non-technical language, to present the outcomes of research findings in written and oral form clearly and successfully. | Communication, ICT and Numeracy Skills [Level 9] |
| **D3** | **Organizational and Developmental Skills:** Engage in life-long learning and continuing self-development to hone professional and organizational skills required in IT and Computer Science research. | Competence: Autonomy, Responsibility and Context [level 9] |
| **D4** | **Ethical and Social Responsibility:** Recognize, value, and demonstrate current ethics as applied to research in technical fields and social issues likely to be encountered in current use of Information Technology (IT) and Computer Science. | Competence: Autonomy, Responsibility and Context [Level 9] |

## Course Structure (Outline)

| Course Structure (Outline) | | | | | | |
|---|---|---|---|---|---|---|
| **Week** | **Hours** | | **ILOs** | **Topics** | **Teaching Method** | **Assessment Method** |
| | **Lec.** | **Lab** | | | | |
| 1 | 3 | - | A1, A2 | **Types of Research**<br><br>Types of Research – Application Perspective, Objective Perspective, Mode of Enquiry perspective | Lecture, Class discussions | To be covered in Interim Project |
| 2 | 3 | - | A2 | **Formulating a Research Problem**<br><br>Literature Review, Research Objectives | Lecture, Class discussions | To be covered in Interim Project |
| 3 | 3 | - | A1,B1, C1 | Identifying Study Population, Identifying Variables, Constructing Hypotheses | Lecture, Class discussions | To be covered in Interim Project |
| 4 | 3 | - | A1,A2,B 1 | **Conceptualizing a Research Design**<br><br>Meaning of Research Design, Important Functions of Research Design, Study Designs in Qualitative and Quantitative Research | Lecture, Presentation, Oral Inquiry, Class discussions | To be covered in Interim Project |
| 5 | 3 | - | A1, A2, B1 | **Construction of Tools/Instruments of Research**<br><br>Methods of Data Collection, Attitudinal Scales, Measurement Scales, Validity and Reliability | Lecture, Presentation, Oral Inquiry, Class discussions in Group | To be covered in final Project |
| 6 | 3 | - | A2,D1 | **Writing a Research Proposal**<br><br>Stating the Problem, Objectives of the Study, Hypotheses to be Tested | Lecture, Presentation, Oral Inquiry, Class discussions in Group | To be covered in final Project |

| 7 | 3 | - | A2,D1 | **Writing a Research Proposal continued**<br><br>University Guidelines for Master Dissertation | Lecture, Presentation, Oral Inquiry, class discussions in Group | To be covered in final Project |
|---|---|---|---|---|---|---|
| 8 | 3 | - | A1,B1 | **Selecting an Appropriate Sample Size**<br><br>Concept of Sampling, Methods of Sampling, Calculation of Sample Size | Lecture, Class discussions | To be covered in final Project/ Major Exam |
| 9 | 3 | - | A2, A3, D4 | **Research Ethics**<br><br>Ethical Issues Including Perils of Plagiarism, Acknowledging Other Peoples' Work,  Proper Ways of Referencing. | Lecture, Class discussions | To be covered in final Project/ Major Exam |
| 10 | 3 | - | A1,B1,C 1,C2 | **Quantitative Research Methods**<br><br>Estimation, Confidence Intervals, Construction of the Null Hypothesis and the Alternative Hypothesis | Lecture, Presentation, Oral Inquiry, Class discussions | To be covered in final Project / Major Exam |
| 11 | 3 | - | A1,B1,B 3,C1 | **Quantitative Research Methods Continued**<br><br>ANOVA, Linear Regression and Correlation, Using Some Important Software including Excel and SPSS | Lab session and software demo,<br><br>Class discussions | To be covered in final Project/ Major Exam |
| 12 | 3 | - | A1,B1,B 3, C1,C2 | **Quantitative Research Methods Continued**<br><br>Multiple Linear Regression and Correlation, Using Some Important Software including Excel and SPSS | Lab session and software demo,<br><br>Class discussions | To be covered in final Project/ Major Exam |
| 13 | 3 | - | A2, C1 | **Report Writing**<br><br>Interpretation of Results, Conclusions, Limitations of  Study, | Lecture, Presentation, Oral Inquiry, Class | To be covered in final Project |

| | | | | Suggestions for Further Research | discussions | |
|---|---|---|---|---|---|---|
| 14 | 3 | - | A2, A3, C3, D3 | **Report Writing Continued**<br><br>University Guidelines for Writing Master Dissertation | Lecture, Presentation, Oral Inquiry, Class discussions | To be covered in final Project |
| 15 | 3 | - | A1, A2, B1, C1 | **Presentations** | Discussion | Evaluation of Interim Project |
| 16 | 2 | | A1, A2, A3, B1, B2, B3, C1, C2, C3, D1, D3, D4 | **Presentations** | | **Final Project** |

\* Formative assessment

## Teaching Materials:

| | |
|---|---|
| **Textbook(s):** | 1- Ranjit Kumar, *Research Methodology – A Step by Step Guide for Beginners,* 5th Edition, SAGE, 2019, **ISBN-1O:** 1526449900, **ISBN-13:** 978-1526449900<br>2- John W. Creswell, J. David Creswell, Research Design: Qualitative, Quantitative, and Mixed Methods Approaches Fifth Edition, SAGE Publications, Inc, 2018, ISBN: 1506386709. |
| **Handout(s):** | PowerPoint slides available on Moodle i.e. http://www.ahlia.edu.bh/moodle |
| **Reference(s):** | 1. Manuel Mora, *Research Methodologies, Innovations and Philosophies in* Software Systems, Engineering and Information, IGI Global, 2012.<br><br>2. Monique Hennink, Inge Hutter and Ajay Bailley, *Qualitative Research Methods,* SAGE, 2011. ISBN: 9781412922265.<br><br>3. C. R. Kothari, *Research Methodology: Methods and Techniques,* 2nd Edition, New Age International, , ISBN: 81224125223<br>4. Martin S. Olivier, , *Information Technology Research – A Practical Guide for Computer Science and Informatics,* 3rd Edition, Van Schaik, 2009, ISBN: 9780627027581. |

**Assessment**

| Method of Assessment | Description | Learning Outcomes | Weighting |
|---|---|---|---|
| Major Exam | Written exam to assess student skills in research ethics, and methods. | A1, B1, B2, C1 | 20 % |
| Project 1 | On topics covered in weeks 1-4 | A1, A2, B1, C1 | 20 % |
| Project 2 | A comprehensive research proposal describing the prospective research components eligible for a Masters level | A1, A2, A3, B1, B2, B3, C1, C2, C3, D1, D3, D4 | 60 % |
| **Overall:** | | | **100 %** |

# Project 1

## Requirements:

Choose an academic article and produce a critical summary that is no more than 1200 words. The article should be recent i.e. published after 2009. Your summary can be based on answering the questions given the section below (where appropriate). Please do not write just a list of answers. It is important to provide a cohesive summary that has within it the answers.

## *Summary contents (questions you should answer about the paper):*

### Research problem formulation

Is the research problem sufficiently important? Is it likely to produce new or useful information? Is the problem complex? Are prior theory and (if there) empirical work explained clearly? Are the outcomes stated clearly? Are the outcomes justified?

### Literature Review

Does the investigator demonstrate familiarity with pertinent literature? Is the literature review comprehensive and well organised putting forward clearly the concepts/frameworks the author aims to explore?

### Methodology

Is the chosen methodology appropriate to address the main research question? Are there too many variables included? Is the description of the research design sufficiently clear and specific

to permit rigorous evaluation? Does the author demonstrate familiarity with relevant methodological literature and techniques? Is the data suitable to the research objective?

## Data Collection

Are data collection plans realistic? Do they raise ethical issues? Are plans offered for ruling out alternative explanations for results?

## Findings

Does the investigator summarise the findings in a concise manner? Are the findings well-articulated and discussed within the literature?

## Recommendations

Does the investigator offer recommendations for further research and are they justified adequately? Does the investigator suggest policy recommendations based on the findings? Are they well argued?


**MARKING SCHEME**

| Grade Requirements | Grade |
|---|---|
| Pass (C): The student has summarised the article in a sway that can be understood by the reader without the need to read the original article itself. The student attempted to criticise the article in most of the areas that has been suggested. Also the student is using comparative purposes some of the literature that has been found from the article's references. | Grade C |
| Very Good (B): gives a well written summary based on an article from a good quality journal. Evidence of further reading is provided. The student has reflected and dealt with many of the issues/suggestions provided with the assignment. | Grade B |
| Excellent (A): gives an extremely well written summary based on an article from a top rated journal. Evidence of further reading is provided i.e. papers that have been read after the publication of the article used for the assignment. The student has reflected and dealt with most of the issues/suggestions provided with the assignment. | Grade A |
| Failure to meet the requirements in of C | Other |


# Project 2

# Background

You will illustrate the problem which your research will be addressing, explain its academic and industrial context, demonstrate a knowledge and understanding of past and current work in the subject area by synthesising (analysing) at least 5 academic references of relevance to your work.

[the first paragraph will usually introduce the general area of the project]

[the next paragraph(s) will describe some previous work in this area; where you reference previous research use the format "Jones and Bloggs (1999) argued…" or "it has been found that…(Patel, 2002)", i.e. only author surname(s) and date should appear here - full details of the reference appear in the reference list (see below)]

[the final paragraph will present a problem which the discussion of previous work suggests is still unsolved - this should be the problem or question your project will address]

# Aims and Objectives

In this section you should define the overall aim of the project and the specific measurable objectives that you plan to achieve. You should phrase your objectives in a way that once achieved they will demonstrate the successful achievement of the overall project's aim.

[the aim(s) should be general and broad; often it/they can be phrased in terms of solving a practical problem, answering a question or improving a business in some way; stick to one general aim]

[the objectives should be specific and measurable; the sum of your objectives should equal the achievement of the aim(s); it should be possible for you to evaluate your project by assessing whether it has met the objectives]

# Methodological Approach

This should include some information on the general methodological approach you intend to adopt for your study, the accessibility of the data you intend to collect and the techniques you intend to use for data collection and data analysis.

[your project involves producing a solution to a practical problem, the method is the procedure you follow to come up with this solution; often the method will involve some form of interaction with potential participants (e.g. interviews, surveys, case studies, experiments, observations), the analysis of which should inform the solution design; for some projects the method may involve analysis of existing data to inform the solution (examples might include a conceptual analysis based on what others have written, a statistical analysis using an existing data set, or a structured analysis of an existing published data set); try to give a good justification as to why the method you have chosen is suitable for your problem]

[you will most likely want to base your actual methodological approach around an established business and social sciences methodology - you can mention this here but try to keep it brief; if you have chosen a particular methodology just say which one with a brief justification; if you have yet to choose a methodology then mention the candidates and how you intend to choose between them]

# Programme of Work

In this section you should describe the tasks you need to conduct in order to complete the project, identify the major milestones by which you and your supervisor will monitor the progress of your project (e.g. completion of literature review, completion of data collection). The programme of work should be illustrated by a simple diagrammatic work plan showing the major tasks and milestones against a timeline. The work plan is not included in the words limit of the detailed research proposal and represents a one-page 'appendix' to this report.

[the general format of this section is illustrated below:

Task 1: task title (estimated effort N weeks)

[brief description of the task]

Milestone 1: milestone name

[together the tasks you perform should allow you to meet your stated objectives - you may find it helpful to refer to these in writing the task descriptions]

# References

At least 5 academic references relevant to your research proposal using the Harvard style.

[provide an alphabetical list, ordered by first author surname, of all references you cite in the text of this report; the accepted format style for referencing is the Harvard style - search on Google for "Harvard referencing" to find lots of useful resources on how to do this]

[you can adapt the table below to show your own plan; it is fine if you wish to use project planning software to develop your plan, however you must produce a version which can be inserted into the word document which you submit electronically for part 2]

| Task Id | Task Name | Wk 1 | Wk 2 | Wk 3 | Wk 4 | Wk 5 | Wk 6 | Wk 7 | Wk 8 | Wk 9…. | Wk n |
|---------|-----------|------|------|------|------|------|------|------|------|--------|------|
| 1 | Project Planning | | | | ◆ | | | | | | |
| 2 | Library Work | | | | | | | | | | |
| 3 | Planning Survey | | | | | | ◆ | | | | |
| 4 | Data Collection | | | | | | | | | ◆ | |

| 5… | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|

◆

= milestone

| |
|---|

= key task

## MARKING SCHEME

| Grade Requirements | Grade |
|---|---|
| Pass (C): A coherent response to the requirements of the assessment task: the report's overall structure and writing quality is adequate; the reference list is complete (and organised alphabetically in Harvard format); the word limit is not exceeded; evidence of accurate restatement and organisation of relevant concepts, methodology and material appropriate to writing a short report for the lay person. Clarity of the problem statement and the implementation of the method used. | Grade C |
| Very Good (B): The requirements for a grade C are met. In addition:<br>• Demonstrates skills in organising, presenting and interpreting knowledge from the relevant sources;<br>• Explains the general merits and demerits of any material reviewed;<br>• Is neatly formatted with few typographical or grammatical errors;<br>• Demonstrates a confident level of understanding based on an assured grasp of relevant concepts, methodology and content appropriate to writing a short report.<br>• Evidence of significant skill in interpreting complex material articulated with a high level of competence.<br>• Provide good justifications of the steps followed in selecting, implementing and experimenting with the researched concept. | Grade B |
| Excellent (A): The requirements for a grade B are met. In addition:<br>• Provide excellent and convincing justifications of the steps followed in selecting, implementing and experimenting with the method used.<br>• Demonstrates excellent skills in interpreting lay information and converting them into a theoretical model.<br>• Demonstrates evidence of a consistently authoritative grasp of concepts, methodology and content appropriate to writing a report, with evidence of depth and confidence in the understanding of issues underpinning the assessment task. | Grade A |
| Failure to meet the requirements of C | Other |

| Admissions | |
|---|---|
| **Pre-requisites** | **Successful completion of at least 9 credits** |
| **Minimum number of students** | 8 |
| **Maximum number of students** | 20 |

**Ahlia University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see** www.ahlia.edu.bh/integrity **for more information).**

**COLLEGE OF INFORMATION TECHNOLOGY**

**DEPARTMENT OF MULTIMEDIA SCIENCE**

**COURSE SYLLABUS/ SPECIFICATION**

| | |
|---|---|
| **Course Code & Title:** | **ITMS 523 – Multimedia Information Systems** |
| **Weight:** | **(3-0-3)** |
| **Prerequisite:** | **None** |
| **NQF Level Allocated:** | **9** |
| **NQF Notional Hours / Credits:** | **120 notional hours/ 12 NQF credit** |

**Description:** This course constitutes an approach to multimedia information systems that are concerned with the capture, storage and presentation of information in a variety of forms, including text, image, video and audio. It presents a general overview of electronic multimedia documents, a deep coverage of XML and XML Databases with particular focus on: (1) developing skills in the design and management of multimedia information systems projects; (2) employing evaluation techniques for multimedia authoring systems and multimedia user interfaces; and (3) developing an understanding of the current state of multimedia applications and their impact on organizations

**Objective:**

1. To provide a detailed overview of Electronic Documents including Multimedia Documents.
2. To explain how to create and manage XML documents
3. To demonstrate how to validate XML documents with DTD and XML Schema
4. To explain how to design, populate and query XML Databases

**Semester:**

**Instructor (s):**

**Office Telephone:**                                        **Email (s):**

**Intended Learning Outcomes (ILOs):**

| A. Knowledge and Understanding | | NQF Descriptor/ Level |
|---|---|---|
| **A1** | **Concepts and Theories:** Demonstrate knowledge and critical understanding of concepts and techniques of multimedia information systems. | Knowledge: theoretical understanding [Level 9] |
| **A2** | **Contemporary Trends, Problems and Research:** Demonstrate critical awareness of contemporary trends, issues and problems in multimedia information systems. | Knowledge: theoretical understanding [Level 9] |
| **A3** | **Professional Responsibility:** Demonstrate an awareness of professional ethics and responsibilities related to the multimedia information systems and XML Databases. | Knowledge: theoretical understanding [Level 9] |

| B. Subject-specific Skills | | NQF Descriptor/ Level |
|---|---|---|
| **B1** | **Problem Solving:** Develop, manipulate and process efficiently various Multimedia Documents having in mind the different efficient designs techniques explored through research | Skills: Communication, ICT and Numeracy Skills [Level 9] <br><br> Knowledge: Practical Understanding [Level 9] |
| **B2** | **Modeling and Design:** Design the architecture of Multimedia Information Systems through the means of XML Documents having in mind the different designs of multimedia information systems-based explored through research. | Skills: Communication, ICT and Numeracy Skills [Level 9] <br><br> Knowledge: Practical Understanding [Level 9] |
| **B3** | **Application of Methods and Tools:** Use and apply appropriate | Skills: |

| multimedia tools to develop and manipulate multimedia documents and create Multimedia Information Systems through the means of electronic documents and XML Databases. | Communication, ICT and Numeracy Skills [Level 9] |
|---|---|

| C. Critical-Thinking Skills | | NQF Descriptor/ Level |
|---|---|---|
| C1 | **Analytic skills:** Analyze cases of XML Document and XML Databases dealing with Multimedia with respect to their nature (qualitative analysis) or proportions (quantitative analysis), in order to identify the best possible alternatives/decisions | Generic cognitive skills [Level 9] |
| C2 | **Synthetic:** Align decision-making with strategic objectives in order to select the best possible alternatives as regards cases of XML Document and XML Databases dealing with Multimedia | Generic cognitive skills [Level 9] |
| C3 | **Creative Thinking and innovation:** Demonstrate originality and creativity in relation to the development of efficient multimedia information systems such as XML Document and XML Databases | Knowledge: Practical Understanding [Level 9] |

| D. General and Transferable Skills (other skills relevant to employability and personal development) | | NQF Descriptor/ Level |
|---|---|---|
| D1 | **Communication:** Express and communicate ideas effectively, in written and oral form to colleagues and/or instructor as appropriate. | Communication, ICT and Numeracy Skills [Level 8] |
| D2 | **Teamwork and Leadership:** Work effectively as a member/leader of a team of technical people who may plan, design, implement, manage, and monitor a project | Competence: Autonomy & Responsibility [Level 9] |
| D3 | **Organizational and Developmental Skills:** Engage in life-long learning and continuing self-development to hone professional and organizational skills. | Competence: Autonomy & Responsibility (Level 9) |
| D4 | **Ethics and Social Responsibility:** Recognize, accept, and follow ethical and social responsibility and respond positively to the needs of society by identifying, employing and utilizing effectively the advanced computing and information solutions and technologies. | Competence: Autonomy & Responsibility (Level 9) |

## Course Structure (Outline)

| | | | Course Structure (Outline) | | |
|---|---|---|---|---|---|
| Week | Hours | ILOs | Unit/Module or Topic Title | Teaching Method | Assessment Method |
| 1 | 3 | A1,D4 | Introduction | Lecture | Oral Participation (A1) |
| 2 | 3 | A1, B1, B3, D1 | Multimedia systems architecture and engineering | Lecture/ Lab session demo | Oral Participation (A1, D1) |
| 3 | 3 | A1, B2, B3, C2, D1 | Modeling XML Documents | Lecture, Exercises | Oral Participation (A1, C2) |
| 4 | 3 | A1,B1, B3 | XML | Lecture/ Lab session demo, Exercies | Oral Participation (A1,D1) |
| 5 | 3 | A1, B2, B3, C2, D1 | Modeling Complex XML Documents | Lectures | Oral Participation (A1, C2) |
| 6 | 3 | A1, B1, B2, B3, C1, C2, D1,D3 | Validating XML Documents | Lecture, Exercises | Oral Participation (A1,C1) /**Research Assignment 1** ( A1, B1, B2, B3, C1, C2,D1, D3) |
| 7 | 3 | A1,B2,B3 | XML Schema part 1 | Lecture/ Lab session demo | Oral Participation (A1) |
| 8 | 3 | A1, B1, B2, B3 | XML Schema part 2 | Lecture/ Lab session demo, Exercises | Oral Participation (A1) |
| 9 | 3 | A1, B1, B2, B3, C1, C2, D1 | XML Schema part 3 | Lecture/ Lab session demo, Exercises | **Midterm Exam** ( A1, B1, B2, B3, C1, C2)  Oral Participation (A1) |

| 10 | 3 | A1, B1, B3, C1 | Validating XML Documents with XML Schema | Lecture, Exercises | Oral Participation (A1, C1) |
|---|---|---|---|---|---|
| 11 | 3 | A1, A3, B1, B3, C1 | XML Databases part 1 | Lecture/ Lab session demo/ Case study | Oral Participation (A1, A3) |
| 12 | 3 | A1, A3, B1, B2, B3, C1, C2, D1,D3 | XPATH | Lecture, Exercises | Oral Participation (A1, D1)/ **Research Assignment 2** ( A1, A3, B1, B2, B3, C1, C2, D1,D3) |
| 13 | 3 | A1, A3, B1, B2, B3, C1, C3 | XML Databases part 2 | Lecture/ Lab session demo, Exercises | Oral Participation (A1) |
| 14 | 3 | A1, A2, A3, B1, B2, B3, C1, C3 | More on XML Databases and XQUERY and how to model and write them when dealing with Multimedia Documents | Lecture/ Lab session demo, Exercises | Oral Participation (A1) |
| 15 | 3 | A1, A2, A3, B1, B2, B3, C1, C2,C3, D1,D2,D3, D4 | Student reports and presentations of team research projects | Student presentatio n | **Evaluation of Project Presentations & Reports** (A1, A2, A3, B1, B2, B3, C1, C2,C3, D1,D2,D3, D4) |
| 16 | 2 | | | | **Final Exam** ( A1, A2, A3, B1, B2, B3, C1, C2,C3) |

## Teaching Materials:

| Textbook(s): | Herong Yang, *XML Tutorials – Herong's Tutorials Examples*, Independently published, 2018 |
|---|---|
| Handout(s): | Power point slides, http://www.ahlia.edu.bh/moodle. |
| Reference(s): | 1- E. R. Harold and W. Scott Means, *XML in a Nutshell: A Desktop Quick Reference*, 3rd Ed., O'Reilly Media, 2004 |

| | 2- K. H. Goldberg, *XML: Visual QuickStart Guide*, 2nd Ed., Peachpit Press, 2008. |
| :---: | :--- |
| | 3- E. T. Ray, *Learning XML*, 2nd Ed., O'Reilly Media, 2003. |
| | **4-** E. R. Harold, *Effective XML: 50 Specific Ways to Improve Your XML*, Addison-Wesley Professional 2003 |

## Assessment

| Method of Assessment | Description | Learning Outcomes | Weighting |
| :--- | :--- | :--- | :---: |
| Research Assignment 1 | The assignment consists of essay, problem-solving and research based theoretical questions covering topics studied in the first 6 weeks. The purpose of the assignment is to assess students individually where they have to demonstrate their extensive and detailed knowledge and critical awareness of current research, trends and advancements in multimedia information systems. The assignment will also assess students' skills in using and applying appropriate multimedia tools such as ALTOVA XML SPY to develop and manipulate multimedia documents and create Multimedia Information Systems through the means of electronic documents and Native XML Databases (NxD). Soft copy submission is required by the end of the 7th week through the course page in Moodle where answers will be checked by Turnitin against plagiarism. Any implementation code developed during this assignment will have to be submitted also electronically to be tested and evaluated. | A1, B1, B2, B3, C1, C2, D1, D3 | 10% |
| Research Assignment 2 | Same as assignment 1 but the topics will cover up to week 12. Students will be also asked to analyze cases of XML Documents including Multimedia Documents and XML Databases with respect to their nature or proportions in order to identify the best possible alternatives/decisions. Soft copy submission is required by the end of the 13th week through the course page in Moodle where answers will be checked by Turnitin against plagiarism. Any implementation code developed during this assignment will have to be submitted also electronically to be tested and evaluated. | A1, A3, B1, B2, B3, C1, C2, D1,D3 | 10% |
| Oral Participation | Students will be questioned orally to demonstrate their understanding and knowledge of the topics covered during class lectures and lab sessions. Feedback will be given to students to reaffirm their learning outcomes. | A1, A3, C1, C2, D1 | Formative |

| | | | |
|---|---|---|---|
| Midterm Exam | The midterm exam will be an in-class 1-hour exam that will consists of short-answer, essay, and problem solving questions and cover the topics studied in the first 9 weeks.  Students will be asked to design and write some XML code for developing and manipulating multimedia documents. | A1, B1, B2, B3, C1, C2 | 20% |
| Team Research Project (Report and Presentation ) | Starting from weak 4, the class will be divided into teams of 4-5 students where each team will be asked to study a research problem in multimedia information systems utilizing the knowledge, skills and tools learned in class. Teams are required to plan and execute the research project that must involve a main component of multimedia tools application using such as ALTOVA XML SPY to develop and manipulate multimedia documents and create Multimedia Information Systems through the means of electronic documents including Multimedia Documents and Native XML Databases (NxD). In the final week, each team will have to submit their research report (worth 14%) explaining the research problem, research methods used, analysis and the conclusion highlighting the research findings and results. The report must explain precisely the work accomplished by each student. Each team will be required to make a presentation (worth 6%) summarizing the research conducted and its findings. Each team member has to participate in the presentation. Team-based work will be examined and evaluated as a whole as well as the individual work of each student. Team members will be tested individually during the presentation by peers and the instructor. | A1, A2, A3, B1, B2, B3, C1, C2,C3, D1,D2,D3, D4 | 20% |
| Final Exam | The final exam is comprehensive and will be of two hours duration. It will consist of short-answer, essay and problem-solving questions. Students will be asked to design and write XML code for some component of multimedia information systems which includes Multimedia Documents. | A1, A2, A3, B1, B2, B3, C1, C2,C3 | 40% |
| **Overall:** | | | **100 %** |

| Admissions | |
|---|---|
| **Pre-requisites** | None |

| | |
|---|---|
| **Minimum number of students** | 4 |
| **Maximum number of students** | 20 |