MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

| **Module Information**  **معلومات المادة الدراسية** | | | | | | | |
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| **Module Title** | Data analysis and visualization | | | | **Module Delivery** | | |
| **Module Type** | Core | | | | * **☒ Theory** * **☐ Lecture** * **☒ Lab** * **☐ Tutorial** * **☐ Practical** * **☐ Seminar** | | |
| **Module Code** | ITC320170 | | | |
| **ECTS Credits** | 6.00 | | | |
| **SWL (hr/sem)** | 150 | | | |
| **Module Level** | | 2 | **Semester of Delivery** | | | | 4 |
| **Administering Department** | | BID | **College** | BMIC | | | |
| **Module Leader** | Mohammed Fadhil | | **e-mail** | mfadhil@uoitc.edu.iq | | | |
| **Module Leader’s Acad. Title** | | Lecturer | **Module Leader’s Qualification** | | | | Ph.D. |
| **Module Tutor** | Mohammed Fadhil | | **e-mail** | mfadhil@uoitc.edu.iq | | | |
| **Peer Reviewer Name** | | omarA.M. | **e-mail** | omara.m@uoitc.edu.iq | | | |
| **Scientific Committee Approval Date** | | 18/06/2023 | **Version Number** | | | 1.0 | |

| **Relation with other Modules**  **العلاقة مع المواد الدراسية الأخرى** | | | |
| --- | --- | --- | --- |
| **Prerequisite module** | Object Oriented Programming / BMI211, Data Structures / BMI212 | **Semester** | 3 |
| **Co-requisites module** | None | **Semester** |  |

| **Module Aims, Learning Outcomes and Indicative Contents**  **أهداف المادة الدراسية ونتائج التعلم والمحتويات الإرشادية** | |
| --- | --- |
| **Module Aims**  **أهداف المادة الدراسية** | 1. To have a clear understanding about data analysis and data science and clarify the concepts of data, information, and knowledge. 2. To Explore different types and structures of data, including structured, unstructured, and semi-structured data. 3. To understand the differences between quantitative and qualitative data and understand their respective applications. 4. To understand data profiling, cleaning, transformation, and scaling. 5. Enable students to apply learned concepts through practical exercises and real-world examples. 6. Equip students with the skills to effectively analyze and interpret data. |
| **Module Learning Outcomes**  **مخرجات التعلم للمادة الدراسية** | 1. Demonstrate a comprehensive understanding of the fundamental concepts and goals of data analysis and data science. 2. Differentiate between data, information, and knowledge and explain their roles in the analysis process. 3. Identify and classify different types and structures of data, including structured, unstructured, and semi-structured data. 4. Compare and contrast quantitative and qualitative data and select appropriate analysis techniques for each type. 5. Apply data profiling techniques to assess the quality, completeness, and reliability of datasets. 6. Implement data cleaning and transformation processes to ensure data consistency and usability for analysis. 7. Apply data scaling techniques to normalize and standardize datasets. 8. Utilize statistical methods and tools to analyze and interpret data accurately. 9. Employ data visualization techniques to effectively communicate insights and patterns derived from the analysis. 10. Apply ethical considerations and privacy principles in data analysis practices. |
| **Indicative Contents**  **المحتويات الإرشادية** | Indicative content includes the following.  Introduction to Data Analysis and Data Science   * Definition and scope of data analysis and data science * Goals and objectives of data analysis * Overview of the data analysis process   Understanding Data, Information, and Knowledge   * Differentiating between data, information, and knowledge * The role of data in decision-making and problem-solving * Transforming data into meaningful information and actionable knowledge   Types and Structures of Data   * Structured, unstructured, and semi-structured data * File formats for different data types (CSV, JSON, XML, etc.)   Quantitative and Qualitative Data Analysis   * Characteristics and properties of quantitative data * Descriptive and inferential statistics for quantitative analysis * Approaches for analyzing qualitative data.   Data Profiling and Cleaning   * Assessing data quality and completeness * Identifying and handling missing or erroneous data * Dealing with outliers and inconsistent data points   Data Transformation and Scaling   * Reshaping and restructuring data for analysis * Normalization and standardization techniques * Feature engineering and dimensionality reduction methods   Statistical Analysis and Modeling   * Exploratory data analysis techniques * Hypothesis testing and statistical inference.   Data Visualization and Communication   * Principles of effective data visualization * Using charts, graphs, and interactive tools to communicate insights. * Storytelling with data to convey meaningful narratives.   Ethical Considerations in Data Analysis   * Privacy and data protection regulations * Ethical implications of data collection and usage * Ensuring fairness and avoiding bias in data analysis   Case Studies and Practical Applications   * Applying data analysis techniques to real-world scenarios * Hands-on exercises and projects using python * Analyzing and presenting insights from diverse datasets |

| **Learning and Teaching Strategies**  **استراتيجيات التعلم والتعليم** | |
| --- | --- |
| **Strategies** | This course adopts a comprehensive approach by combining theoretical knowledge with practical application. Students will engage in interactive lectures and discussions to understand data analysis concepts. Through hands-on exercises and projects using diverse datasets and popular tools, students will develop the skills and confidence needed to apply data analysis techniques effectively. |

| **Student Workload (SWL)**  **الحمل الدراسي للطالب** | | | |
| --- | --- | --- | --- |
| **Structured SWL (h/sem)**  **الحمل الدراسي المنتظم للطالب خلال الفصل** | 63 | **Structured SWL (h/w)**  **الحمل الدراسي المنتظم للطالب أسبوعيا** | 4 |
| **Unstructured SWL (h/sem)**  **الحمل الدراسي غير المنتظم للطالب خلال الفصل** | 87 | **Unstructured SWL (h/w)**  **الحمل الدراسي غير المنتظم للطالب أسبوعيا** | 6 |
| **Total SWL (h/sem)**  **الحمل الدراسي الكلي للطالب خلال الفصل** | 150 | | |

| **Module Evaluation**  **تقييم المادة الدراسية** | | | | | |
| --- | --- | --- | --- | --- | --- |
| **As** | | **Time/Number** | **Weight (Marks)** | **Week Due** | **Relevant Learning Outcome** |
| **Formative assessment** | **Quizzes** | 3 | 10% (10) | 3, 7 and 11 | LO #1, 2, and 6 |
| **Assignments** | 2 | 10% (10) | 5, 12 | LO # 3, 4, and 7 |
| **Projects / Lab.** | 1 | 10% (10) | Continuous |  |
| **Report** | 1 | 10% (10) | 13 | LO # 5, 8 and 10 |
| **Summative assessment** | **Midterm Exam** | 2 hr | 10% (10) | 7,14 | LO # 1-10 |
| **Final Exam** | 3hr | 50% (50) | 16 | All |
| **Total assessment** | | | 100% (100 Marks) |  |  |

| **Delivery Plan (Weekly Syllabus)**  **المنهاج الاسبوعي النظري** | |
| --- | --- |
| **Week** | **Material Covered** |
| **Week 1** | Lecture 1: Introduction to Data Analysis and Data Science |
| **Week 2** | Lecture 2: Understanding Data, Information, and Knowledge |
| **Week 3** | Lecture 3: Types and Structures of Data |
| **Week 4** | Lecture 4: Quantitative Data Analysis: Descriptive Statistics |
| **Week 5** | Lecture 5: Quantitative Data Analysis: Inferential Statistics |
| **Week 6** | Lecture 6: Qualitative Data Analysis Techniques |
| **Week 7** | 1st exam |
| **Week 8** | Lecture 7: Data Profiling: Assessing Data Quality |
| **Week 9** | Lecture 8: Data Cleaning: Handling Missing and Erroneous Data |
| **Week 10** | Lecture 9: Categorical Data Encoding methods |
| **Week 11** | Lecture 10: Data Transformation and Reshaping Techniques |
| **Week 12** | Lecture 11: Statistical Analysis: Exploratory Data Analysis |
| **Week 13** | Lecture 13: Data Visualization: Principles and Techniques |
| **Week 14** | 2nd Exam |
| **Week 15** | **Reveiw** |

| **Delivery Plan (Weekly Lab. Syllabus)**  **المنهاج الاسبوعي للمختبر** | |
| --- | --- |
| **Week** | **Material Covered** |
| **Week 1-2** | Lab 1-2: Introduction to Python for AI and Machine Learning: Setting up the Environment and libraries |
| **Week 3-4** | Lab 3-4: Introduction to Data Analysis with Python |
| **Week 5-7** | Lab 5,6,7: Exploring Data Structures and Manipulation in Python |
| **Week 8-9** | Lab 8, 9: Data Cleaning and Preprocessing Techniques in Python |
| **Week 10** | Lab 10: handling Missing data |
| **Week 11-12** | Lab 11-12: Dealing with outliers |
| **Week 13-14** | Lab 13, 14: Statistical Analysis and Visualization with Python |
| **Week 15** | Presentations and discussions of case studies |

| **Learning and Teaching Resources**  **مصادر التعلم والتدريس** | | |
| --- | --- | --- |
|  | **Text** | **Available in the Library?** |
| **Required Texts** | Python Data Science Handbook, Jake VanderPlas | No |
| **Recommended Texts** | Machine Learning Bookcamp, Alexey Grigorev. | No |
| **Websites** | https://github.com/microsoft/Data-Science-For-Beginners | |

| **Grading Scheme**  **مخطط الدرجات** | | | | |
| --- | --- | --- | --- | --- |
| **Group** | **Grade** | التقدير | **Marks (%)** | **Definition** |
| **Success Group**  **(50 - 100)** | **A -** Excellent | **امتياز** | 90 - 100 | Outstanding Performance |
| **B -** Very Good | **جيد جدا** | 80 - 89 | Above average with some errors |
| **C -** Good | **جيد** | 70 - 79 | Sound work with notable errors |
| **D -** Satisfactory | **متوسط** | 60 - 69 | Fair but with major shortcomings |
| **E -** Sufficient | **مقبول** | 50 - 59 | Work meets minimum criteria |
| **Fail Group**  **(0 – 49)** | **FX –** Fail | **راسب (قيد المعالجة)** | (45-49) | More work required but credit awarded |
| **F –** Fail | **راسب** | (0-44) | Considerable amount of work required |
|  |  |  |  |  |
| **Note:** Marks Decimal places above or below 0.5 will be rounded to the higher or lower full mark (for example a mark of 54.5 will be rounded to 55, whereas a mark of 54.4 will be rounded to 54. The University has a policy NOT to condone "near-pass fails" so the only adjustment to marks awarded by the original marker(s) will be the automatic rounding outlined above. | | | | |