MODULE DESCRIPTION FORM

نموذج وصف المادة الدراسية

| **Module Information**  **معلومات المادة الدراسية** | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Module Title** | Numerical Methods for Bioinformatics | | | | **Module Delivery** | | |
| **Module Type** | Basic | | | | * **☒ Theory** * **☐ Lecture** * **☒ Lab** * **☐ Tutorial** * **☐ Practical** * **☐ Seminar** | | |
| **Module Code** | BID312 | | | |
| **ECTS Credits** | 5 | | | |
| **SWL (hr/sem)** | 125 | | | |
| **Module Level** | | UGx1 3 | **Semester of Delivery** | | | | 5 |
| **Administering Department** | | BID | **College** | BMIC | | | |
| **Module Leader** | Dr. Mazin Hussein Abdullah | | **e-mail** | dr.mazin.hussein@uoitc.edu.iq | | | |
| **Module Leader’s Acad. Title** | | Lecturer | **Module Leader’s Qualification** | | | | Ph.D. |
| **Module Tutor** | Hasanien Kariem Abed Kuba | | **e-mail** | [hasanien.k.a@uoitc.edu.iq](mailto:hasanien.k.a@uoitc.edu.iq) | | | |
| **Peer Reviewer Name** | | omar A. 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** | Discrete Mathematics / BMI213 | **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 understand the biological problem pattern in order to develop a general arithmetic pattern to solve and analysis it through numerical applications 2. To develop technical skills in solving real problems in the biological field through the practical implementation of numerical technique 3. To understand and appraise the theoretical foundations of algorithms 4. develop practical skills for writing computer programs solving numerical problems |
| **Module Learning Outcomes**  **مخرجات التعلم للمادة الدراسية** | 1. The student understands the foundations of numerical methods to reach acceptable approximate arithmetic solutions. 2. The student has the ability to understand the derivation of these concepts and theories of numerical methods by relating them to the bioinformatics branch. 3. The student understands the types of errors in numerical calculations. 4. Define the difference between a sequence and a series and to set up a general arithmetic pattern for each data generated. 5. The student recognizes linear algebra and matrix analysis. 6. Apply the fundamentals of classical iteration methods to find the roots of equations. 7. Apply the methods of interpolation to construct new data points within the range of a discrete set of known data points. 8. Apply the curve fitting methods of linear and non-linear forms to analyze the data. |
| **Indicative Contents**  **المحتويات الإرشادية** | Indicative content includes the following.  **Part A**  - Introduction to numerical analysis in Bioinformatics discuss  Oxygen transport in skeletal muscle (case study)  - Methods used to measure errors. Significant figures, Rounding and chopping  Measurement of cells in a cell-counting device (case study)  - Arithmetic sequence, Geometric sequence and Series  to find the first or fourth terms, and sum of sequence  - Taylor series definition, Maclaurin Series and examples to solve the series.  - Fundamentals of linear algebra (matrix and Vertices), System of Linear Equation, Matrix operations, and Gaussian elimination and examples  - Statistics 1. Histogram  Physical activity of children aged 9–15(case study)  **Part B**  - Statistics 2. Mean, Variance, …. etc.  Covid-19 Statistics (Case Study)  - Root-finding techniques 1. Bisection Method  Rheological properties of blood (case study)  - Root-finding techniques 2. Fixed-point iteration  Rheological properties of blood (case study)  - Root-finding techniques 3. Newton Method  Equilibrium binding of multivalent ligands in solution to cell surfaces (case study).  - More Examples in Root findings by MATLAB program  - Numerical Integration of tabulated data (Trapezoidal Rule)  - Numerical Integration of tabulated data (Simpson Rule) |

| **Learning and Teaching Strategies**  **استراتيجيات التعلم والتعليم** | |
| --- | --- |
| **Strategies** | Type something like: The main strategy that will be adopted in delivering this module is to encourage students’ participation in the exercises, while at the same time refining and expanding their critical thinking skills. This will be achieved through classes, interactive tutorials and by considering type of simple experiments involving some sampling activities that are interesting to the students. |

| **Student Workload (SWL)**  **الحمل الدراسي للطالب** | | | |
| --- | --- | --- | --- |
| **Structured SWL (h/sem)**  **الحمل الدراسي المنتظم للطالب خلال الفصل** | 64 | **Structured SWL (h/w)**  **الحمل الدراسي المنتظم للطالب أسبوعيا** | 4 |
| **Unstructured SWL (h/sem)**  **الحمل الدراسي غير المنتظم للطالب خلال الفصل** | 61 | **Unstructured SWL (h/w)**  **الحمل الدراسي غير المنتظم للطالب أسبوعيا** | 4 |
| **Total SWL (h/sem)**  **الحمل الدراسي الكلي للطالب خلال الفصل** | 125 | | |

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

| **Delivery Plan (Weekly Syllabus)**  **المنهاج الاسبوعي النظري** | |
| --- | --- |
| **Week** | **Material Covered** |
| **Week 1** | Introduction to numerical analysis in Bioinformatics |
| **Week 2** | Methods used to measure Error |
| **Week 3** | Sequence and Series Arithmetic |
| **Week 4** | Taylor series and Maclaurin Series |
| **Week 5** | Matrix and Vertices |
| **Week 6** | system of linear equation |
| **Week 7** | Mid. Exam |
| **Week8** | linear equation using Gaussian elimination |
| **Week 9** | Statistics 1. Histogram |
| **Week 10** | Statistics 2. Mean, Variance, ….etc. |
| **Week 11** | Root-finding techniques 1.Bisection Method |
| **Week 12** | Root-finding techniques 2. Fixed-point iteration |
| **Week 13** | Root-finding techniques 3. Newton Method |
| **Week 14** | Numerical Integration of tabulated data by Trapezoidal Rule |
| **Week 15** | Numerical Integration of tabulated data by Simpson Rule |

| **Delivery Plan (Weekly Lab. Syllabus)**  **المنهاج الاسبوعي للمختبر** | |
| --- | --- |
| **Week** | **Material Covered** |
| **Week 1** | Lab 1: Introduction to MATLAB program |
| **Week 2** | Lab 2: Methods used to measure Error by MATLAB program |
| **Week 3** | Sequence and Series Arithmetic by MATLAB program |
| **Week 4** | Taylor series and Maclaurin Series by MATLAB program |
| **Week 5** | Matrix and Vertices by MATLAB program |
| **Week 6** | system of linear equation by MATLAB program |
| **Week 7** | linear equation using Gaussian elimination by MATLAB program |
| **Week 8** | Statistics 1. Histogram by MATLAB program |
| **Week 9** | Statistics 2. Mean, Variance, ….etc. by MATLAB program |
| **Week 10** | Root-finding techniques 1.Bisection Method by MATLAB program |
| **Week 11** | Root-finding techniques 2. Fixed-point iteration by MATLAB program |
| **Week 12** | Root-finding techniques 3. Newton Method by MATLAB program |
| **Week 13** | Numerical Integration of tabulated data by Trapezoidal Rule by MATLAB program |
| **Week 14** | Numerical Integration of tabulated data by Simpson Rule by MATLAB program |
| **Week 15** | Review and discuss |

| **Learning and Teaching Resources**  **مصادر التعلم والتدريس** | | |
| --- | --- | --- |
|  | **Text** | **Available in the Library?** |
| **Required Texts** | Introduction to Numerical Analysis: Second Edition (Dover Books on Mathematics). by F. B. Hildebrand | no |
| **Recommended Texts** | Numerical Analysis”, Richard L. Burden & J. Douglas Faires,  Brooks/Cole, Cengage Learning,(2011) | No |
| **Websites** | https://www. numerical-methods.com | |

| **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. | | | | |