**Course description form**

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| 1. **Course Name**
 |
| Numerical Engineering Methods |
| 1. **Course Code**
 |
| EP316 |
| 1. **Semester/Year**
 |
| 2n’d Semester/Third Year |
| 1. **The date this description was prepared**
 |
| 17 / 9 / 2023  |
| 1. **Available forms of attendance**
 |
| Face-to-Face theoretical lectures |
| 1. **Number of study hours (total) / number of units (total)**
 |
| 45/3 |
| 1. **Name of the course administrator**
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| Name: Lect. Osama Sahib JafarEmail:assamasahib@uodiyala.edu.iq  |
| 1. **Course objectives**
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| To understand the importance of numerical methods in solving engineering problems.Solution of non-linear equations and root findings.Solving sets of linear and non-linear equations.Numerical integration and differentiation.Interpolation and solving differential equations. | **Objectives of the study subject** |
| 1. Solution of non-linear equations and root findings.
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| Solving sets of linear and non-linear equations. | **The Strategy**  |
| 1. Numerical integration and differentiation.
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| Interpolation and solving differential equations. | **Learning method** | **Required learning outcomes** | **Name of the unit or topic**  | **Hours** | **Week** |
| Daily, oral, monthly, written examinations and reports | Whiteboard and Data show | Introducing the student to the numerical methods and the reason and applications of numerical mathermatics. | Introduction: why numerical methods | 3 | 1 |
| Daily, oral, monthly, written examinations and reports | Whiteboard and Data show | Finding roots of linear and nonlinear equations using different methods. | Solution of non-linear equations (roots finding): graphical method, bisection method | 3 | 2 |
| Daily, oral, monthly, written examinations and reports | Whiteboard and Data show | Using Newton and secant method in finding roots. | method of iteration, Newton's method, the secant method. | 3 | 3 |
| Daily, oral, monthly, written examinations and reports | Whiteboard and Data show | Solving linear system of equations using Gaussian elimination method. | Solving sets of linear equations: matrix notation, Gaussian elimination method | 3 | 4 |
| Daily, oral, monthly, written examinations and reports | Whiteboard and Data show | Finding inverse and LU factorization method. | , evaluation of the inverse of a matrix, matrix inverse method, LU factorization method | 3 | 5 |
| Daily, oral, monthly, written examinations and reports | Whiteboard and Data show | Finding eigen-values and eigen-vectors numerically. | Eigen values and Eigenvectors | 3 | 6 |
| Daily, oral, monthly, written examinations and reports | Whiteboard and Data show | Studying interpolation with multiple degrees. | Numerical interpolation: polynomial interpolation, linear interpolation, quadratic interpolation, higher degree interpolation (LaGrange's interpolation) | 3 | 7 |
| Daily, oral, monthly, written examinations and reports | Whiteboard and Data show | Using numerical integration methods to solve integration problems. | Numerical integration(trapezoidal, Simpson 1/3) | 3 | 8 |
| Daily, oral, monthly, written examinations and reports | Whiteboard and Data show | Using simpson 3/8 to solve integration method. | Numerical Integration p2(Simpson 3/8) | 3 | 9 |
| Daily, oral, monthly, written examinations and reports | Whiteboard and Data show | Using numerical techniques to differentiate different functions. | Numerical differentiation | 3 | 10 |
| Daily, oral, monthly, written examinations and reports | Whiteboard and Data show | Using Eulers method to solve ODE. | Solving Differential equations using Numerical methods( Euler’s Method) | 3 | 11 |
| Daily, oral, monthly, written examinations and reports | Whiteboard and Data show | Using Runge-Kutta to solve ODE problems | Solving Differential equations using Numerical methods(Runge-Kutta) Method | 3 | 12 |
| Daily, oral, monthly, written examinations and reports | Whiteboard and Data show | Using numerical techniques to learn curve fittings.. | Curve fitting. | 3 | 13 |
| Daily, oral, monthly, written examinations and reports | Whiteboard and Data show | Using Gauss-Seidel Method to solve system of non-linear equations. | Solving Set of nonlinear Equations. | 3 | 14 |
| Daily, oral, monthly, written examinations and reports | Whiteboard and Data show | Using Taylor series method to find numerical values of different mathematical functions. | Taylor Series. | 3 | 15 |
| 1. **Course Evaluation**
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| Distribution of the grade out of 100 according to the tasks assigned to the student, such as daily preparation, daily, oral, monthly, written exams, reports, etc. |
| 1. **Learning and teaching resources**
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| Numerical analysis, Richard L. Burden | Required textbooks (methodology, if any) |
| Numerical methods for engineers and scientists using MATLAB, Ramin S. Esfandiari | Main references (sources) |
| Numerical Methods for engineers, Chapra. | Recommended supporting books and references (scientific journals, reports....) |
|  | Electronic references, Internet sites |