**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** | | | | | | | | |
| Name: Lect. Osama Sahib Jafar Email:[assamasahib@uodiyala.edu.iq](mailto:assamasahib@uodiyala.edu.iq) | | | | | | | | |
| 1. **Course objectives** | | | | | | | | |
| 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. | | | | | | | | |
| Solving sets of linear and non-linear equations. | | | **The Strategy** | | | | | |
| 1. Numerical integration and differentiation. | | | | | | | | |
| 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** | | | | | | | | |
| 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** | | | | | | | | |
| 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 | | | |