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| Image result for nit meghalaya logo | **National Institute of Technology Meghalaya**An Institute of National Importance | **CURRICULUM** |
| Programme | **Bachelor of Technology** | Year of Regulation | **2019-20** |
| Department | **Civil Engineering** | Semester | **V** |
| CourseCode | Course Name | **Pre requisite** | Credit Structure | Marks Distribution |
| L | T | P | C | INT | MID | END | Total |
| **CE317** | **Computational Methods in Engineering** | **Nil** | **3** | **0** | **0** | **3** | **50** | **50** | **100** | **200** |
| CourseObjectives | To provide suitable and effective methods called Numerical Methods, for obtaining approximate representative numerical results of the problems. | Course Outcomes | CO1 | To apply and understand the Numerical analysis  |
| To solve problems in the field of Applied Mathematics, Theoretical Physics and Engineering which requires computing of numerical results using certain raw data | CO2 | To familiarize with finite precision computation. |
| To solve complex mathematical problems using only simple arithmetic operations.  | CO3 | To familiarize with numerical solutions of nonlinear equations in a single variable.  |
| To deal with various topics like finding roots of equations, solving systems of linear algebraic equations, interpolation and regression analysis, numerical integration & differentiation, solution of differential equation, boundary value problems, and solution of matrix problems.  | CO4 | To familiarize with numerical integration and differentiation, numerical solution of ordinary differential equations.  |
| To facilitate numerical computing. | CO5 | To familiarize with calculation and interpretation of errors in numerical method.  |
|  | CO6 | To familiarize with programming with numerical packages like MATLAB |
| No. | COs | Mapping with Program Outcomes (POs) | Mapping with PSOs |
| PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| 1 | CO1 | **3** | **3** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **3** |
| 2 | CO2 | **3** | **3** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **3** |
| 3 | CO3 | **3** | **3** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **3** |
| 4 | CO4 | **3** | **3** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **3** |
| 5 | CO5 | **3** | **3** | **0** | **0** | **0** | **0** | **3** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **3** |
| 6 | CO6 | **3** | **3** | **0** | **0** | **0** | **0** | **3** | **0** | **0** | **0** | **0** | **0** | **0** | **0** | **3** |
| SYLLABUS |
| No. | Content | Hours | COs |
| I | **Errors and Accuracy**Approximate numbers and significant figures, absolute error, relative error and percentage error, error in determinants, accuracy and precision | **03** | **CO1, CO2** |
| II | **Polynomial Approximation and Interpolation**Relation between difference and derivatives, Newton’s forward and backward interpolation, divided difference, Newton’s general interpolation formula, Lagrange’s interpolation formula, accuracy of Newton’s and Lagrange’s interpolation, Gauss’s central-difference formula, multivariate approximation, least squares approximation | **03** | **CO1, CO2** |
| III | **Numerical Solution of Transcendental Equation**Approximate value of the root, regula Falsi method, Newton-Raphson method, error and geometric significant of Newton-Raphson method, method of iteration, convergence of Newton-Raphson and iteration methods, Newton-Raphson method for simultaneous equations | **06** | **CO3, CO4** |
| IV | **Numerical Differentiation and Difference Formulas** Taylor series approach, difference formulas, general quadrature formula, Simpson’s rule, trapezoidal rule, Gauss’s quadrature formula, Euler’s quadrature | **06** | **CO3, CO4** |
| V | **Numerical Solution to Ordinary Differential Equation**Euler’s method, stability analysis of Euler’s method, Picard’s method of successive approximation, Milne’s method, Runge-Kutta method | **06** | **CO4, CO5** |
| VI | **Finite Difference Method**Introduction toFinite Difference, Difference equation, initial and boundary conditions, forward difference, backward difference, central difference, explicit and implicite approach, no uniform grids, errors and stability analysis, Courant number, Lax equivalence theorem,Crank-Nicolson method, Lax-Wendroff technique, MacCormack’s technique, ADI technique, coordinate transformation of equations, transformation of governing equation to suitable coordinate axes | **06** | **CO5, CO6** |
| VII | **Introduction to Finite Element Method**Rayleigh-Ritz and Galerkin methods, finite element method for boundary value problems, finite element method for Laplace (Poisson) and diffusion equations | **06** | **CO5, CO6** |
| Total Hours | **36** |  |
| **Essential Readings** |
| 1. J. B. Scarborough, “Numerical Mathematical Analysis”, Oxford & IBH Publishing Co Pvt.
 |
| 1. K. H. Huebner, D. L. Dewhirst, D. E. Smithand T. G. Byrom,“The Finite Element Method for Engineers”, John Wiley & Sons
 |
| 1. J. D. Anderson Jr, “Computational Fluid Dynamics”, McGraw-Hill Higher Education.
 |
| **Supplementary Readings** |
| 1. J. D. Hoffmanm and S. Frankel, “NumericalMethods for Engineers and Scientists”, CRC Press.
 |
| 1. Balagurusamy: Numerical Methods, Scitech.
 |
| 1. N. Dutta: Computer Programming & Numerical Analysis, Universities Press.
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