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|  | **National Institute of Technology Meghalaya**An Institute of National Importance | **CURRICULUM** |
| Programme | **Master of Technology (Structural Engineering)** | Year of Regulation | **2018** |
| Department | **Civil Engineering** | Semester | **II** |
| Course Code | Course Name | Pre-requisite | Credit Structure | Marks Distribution |
| L | T | P | C | INT | MID | END | Total |
| **CE 526** | **SOFT COMPUTING LAB II** | **NIL** | **0** | **0** | **2** | **1** |  | **100** | **100** |
| Course Objectives | To develop the student’s knowledge on understanding of writing codes on basics of Finite Element Method (FEM) and its implementation using commercial finite element software and MATLAB. | Course Outcomes | CO1 | Possess a good understanding of the theoretical basis of the weighted residual Finite Element Method. |
| CO2 | Be able to use the commercial Finite Element packages to build Finite Element models and solve a selected range of engineering problems. |
| CO3 | Be able to validate a Finite Element model using a range of techniques. |
| CO4 | Be able to communicate effectively in writing to report (both textually and graphically) the method used, the implementation and the numerical results obtained. |
| CO5 | Be able to discuss the accuracy of the Finite Element solutions |
| SYLLABUS |
| No. | Content | Hours | COs |
| **I** | Bar element: Formulation of local and global stiffness matrix using linear and quadratic shape functions; Application in the field of structural mechanics (mechanical and thermal loading, etc.); Validation of the above formulation using any commercial finite element code.  | 2 | CO1 |
| **II** | Trusses: Formulation of stiffness matrix in local and global coordinate system using shape functions; Calculating stress and deflection; Validation of the above formulation using any commercial finite element code.  | 2 | CO2 |
| **III** |  Beam element: Formulation of local and global stiffness matrix using shape functions; Application in the field of structural mechanics; Validation of the above formulation using any commercial finite element code.  | 2 | CO3 |
| **IV** | Frames: Formulation of stiffness matrix in local and global coordinate system using shape functions; Application in the field of structural mechanics; Validation of the above formulation using any commercial finite element code.  | 2 | CO4 |
| **V** | Linear triangular elements: Formulation of stiffness matrix using constant strain triangles, Formulations of axisymmetric problems using constant strain triangles; Validation of the above formulation using any commercial finite element code. arrays  | 2 | CO5 |
| **VI** |  Isoparametric formulations: Formulation of stiffness matrix using 4-noded quadrilaterals, hexahedral and higher order elements; Application in the field of structural mechanics; Validation of the above formulation using any commercial finite element code. | 1 | CO1 |
| **VII** |  Dynamic considerations: Formulation of mass matrix; Evaluation of Eigen values and Eigen vectors; Application in the field of structural mechanics; Validation of the above formulation using any commercial finite element code. | 1 | CO2 |
|  | Total Hours | 12 |  |
| **Essential Readings** |
| 1. Smith, I.M., Griffits, D.V., Margetts, L., “*Programming the finite element method*”, Wiley. |
| 2. Bang, H., Kwon, Y. W., “*The Finite Element Method Using MATLAB*”, CRC Press.. |
| 3. Peter, K., “*Matlab Guide to Finite Elements: An Interactive Approach*”, Springer International. |
| **Supplementary Readings** |
|  1. Chandrupatla, T. R., Belegundu, A. D., “*Introduction to Finite Elements in Engineering*”, PHI.  |
|  2. Reddy, J. N., “*An Introduction to the Finite Element Method*”, Tata McGraw Hill, 2nd Ed, 2003. |
|  3. Cook, R. D., Malkus, D. S., and Plesha, M. E., “*Concepts and Applications of Finite Element Analysis*”, John Wiley & Sons, 4th Ed, 2002. |
| 4. Bathe, K. J., “*Finite Element Procedures*”, Prentice Hall of India Pvt. Ltd., 2002. |