|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | | | | | | | | | | **VI** | | | | | | |
| Course  Code | | Course Name | | | | | | | | **Pre requisite** | | | | Credit Structure | | | | | | | | Marks Distribution | | | | | | | | | | | |
| L | | T | | | P | C | | INT | | | MID | | | END | | | | Total | |
| **CE320** | | **Continuum Mechanics** | | | | | | | | **Nil** | | | | **3** | | **0** | | | **0** | **3** | | **50** | | | **50** | | | **100** | | | | **200** | |
| Course  Objectives | | To provide the students with a foundation in Continuum Mechanics | | | | | | | | | | Course Outcomes | | | | CO1 | | | Apply the tensor formalism | | | | | | | | | | | | | | |
| To learn the conservation principles and derive the equations governing the mechanics of solids and fluids within the continuum hypothesis | | | | | | | | | | CO2 | | | Treat general stresses and deformations in continuous materials | | | | | | | | | | | | | | |
| To learn the constitutive equations for solid and fluids. 4) To develop practical skills in working with tensors | | | | | | | | | | CO3 | | | Formulate and solve specific technical problems of displacement, strain and stress | | | | | | | | | | | | | | |
| To develop problem solving skills, applying the conservation principles and the constitutive equations to solve practical engineering problems | | | | | | | | | | CO4 | | | Perform experiments with stresses and deformations. | | | | | | | | | | | | | | |
|  | | | | | | | | | | CO5 | | | Numerically model and analyse the stresses and deformations of simple geometries under an arbitrary load in both solids and liquids. | | | | | | | | | | | | | | |
|  | | | | | | | | | | CO6 | | |  | | | | | | | | | | | | | | |
| 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** | | | | **0** |
| 2 | CO2 | | **3** | | **3** | **3** | **0** | **0** | **0** | | **0** | | **0** | | **0** | | | **0** | | | **0** | | **0** | | | **0** | | | **0** | | | | **3** |
| 3 | CO3 | | **3** | | **3** | **3** | **0** | **0** | **0** | | **0** | | **0** | | **0** | | | **0** | | | **0** | | **0** | | | **0** | | | **0** | | | | **3** |
| 4 | CO4 | | **3** | | **3** | **3** | **0** | **0** | **0** | | **0** | | **0** | | **0** | | | **0** | | | **0** | | **0** | | | **0** | | | **0** | | | | **3** |
| 5 | CO5 | | **3** | | **3** | **3** | **0** | **0** | **0** | | **3** | | **0** | | **0** | | | **0** | | | **0** | | **0** | | | **0** | | | **3** | | | | **3** |
| 6 | CO6 | | **3** | | **3** | **3** | **0** | **0** | **0** | | **3** | | **0** | | **0** | | | **0** | | | **0** | | **0** | | | **0** | | | **3** | | | | **3** |
| SYLLABUS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| No. | Content | | | | | | | | | | | | | | | | | | | | | | | Hours | | | | | | | COs | | |
| I | **Essential Mathematics**  Scalars, vectors and Cartesian tensors, tensor algebra, Kronecker delta, Levi-Civita symbol, covariant and contra variant tensor, quotient law of tensors, elementary tensor calculus, Green's theorem, integral theorems of Gauss and Stokes. | | | | | | | | | | | | | | | | | | | | | | | 04 | | | | | | | CO1 | | |
| II | **Kinematics of Deformation**  Continuum hypothesis, properties of a continuous medium, spatial (Eulerian) and material (Lagrangian) description of motion of deformable bodies, measure of strain deformation, infinitesimal strain tensor, change in volume due to strain deformation, strain quadric, principle strain, strain invariant. | | | | | | | | | | | | | | | | | | | | | | | 04 | | | | | | | CO2 | | |
| III | **Theory of Motion**  Material derivative, stream line and path line, strain rate tensor, time rate of change of volume element, time rate of change of volume and line integrals, Reynolds’s transport theorem, velocity potential, rotation and vorticity | | | | | | | | | | | | | | | | | | | | | | | 06 | | | | | | | CO3,CO4 | | |
| IV | **Stress Principles**  Body and surface forces, stress tensor, continuity equations, Cauchy’s first and second equation of motion, energy equation, principle stress, principal stress direction. | | | | | | | | | | | | | | | | | | | | | | | 06 | | | | | | | CO3, CO4 | | |
| V | **Elastics Solid**  Constitutive equation for linearly elastic solid-generalized Hooke’s law, elastic constants | | | | | | | | | | | | | | | | | | | | | | | 08 | | | | | | | CO5 | | |
| VI | **Fluid**  Behavior of the fluid, derivation of equation of continuity and momentum from Reynold’s transport theorem and its application in engineering problems, constitutive equations, derivation of Navier-Stoke’s equation, introduction to laminar flow, Bernoulli’s equation and its applications, energy equation for viscous fluid | | | | | | | | | | | | | | | | | | | | | | | 08 | | | | | | | CO5 | | |
| Total Hours | | | | | | | | | | | | | | | | | | | | | | | | **36** | | | | | |  | | | |
| **Essential Readings** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. R. Chatterjee, “Mathematical Theory of Continuum Mechanics”, Narosa Publishing House. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. G. T. Mase and G. E. Mase, “Continuum Mechanics for Engineers”, CRC Press.3.V. L. Streeter, E. B. Wylie and K. W. Bedford, “Flu | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. V. L. Streeter, E. B. Wylie and K. W. Bedford, “Fluid Mechanics”, McGraw Hill Education India Private Limited | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Supplementary Readings** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Continuum Mechanics, A. J. M. Spencer | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Introduction to the Mechanics of a Continuous Medium, L. E. Malvern | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Continuum Mechanics, P. Chadwick | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |