|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Image result for nit meghalaya logo | | | | **National Institute of Technology Meghalaya**  An Institute of National Importance | | | | | | | | | | | | | | | | | | | | | | | **CURRICULUM** | | | | | |
| Programme | | | | **Bachelor of Technology in Civil Engineering** | | | | | | | | | | | | | Year of Regulation | | | | | | | | | | **2020** | | | | | |
| Department | | | | **Civil Engineering** | | | | | | | | | | | | | Semester | | | | | | | | | | **VI** | | | | | |
| Course  Code | | Course Name | | | | | | | | **Pre requisite** | | | | Credit Structure | | | | | | | | Marks Distribution | | | | | | | | | | |
| L | | T | | | P | C | | INT | | | MID | | | END | | | Total | |
| **CE316** | | **Pavement Design** | | | | | | | | **Nil** | | | | **3** | | **0** | | | **0** | **3** | | **50** | | | **50** | | | **100** | | | **200** | |
| Course  Objectives | | To gain basic understanding of the basic principles and philosophy of pavement analysis and design. | | | | | | | | | | Course Outcomes | | | | CO1 | | | Students will be able to understand the various philosophies and principles of pavement design. | | | | | | | | | | | | | |
| To analyze and design flexible and rigid pavements using different Empirical, semi-empirical and theoretical approaches | | | | | | | | | | CO2 | | | Students will be able to analyze and design flexible pavements as per relevant practices. | | | | | | | | | | | | | |
| To inculcate in students the basic concepts of Reliability and its use in the field of pavement engineering | | | | | | | | | | CO3 | | | Students will develop the ability to analyze and design rigid pavements as per relevant practices. | | | | | | | | | | | | | |
| To gain knowledge about the various methodologies of drainage design. | | | | | | | | | | CO4 | | | Students will learn to carry out reliability analysis of pavement structures. | | | | | | | | | | | | | |
|  | | | | | | | | | | CO5 | | | Students will be able to design the drainage features of pavements. | | | | | | | | | | | | | |
| 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 | | 0 | | 0 | 0 | 0 | 0 | 1 | | 1 | | 3 | | 0 | | | 0 | | | 0 | | 1 | | | **0** | | | **0** | | | **0** |
| 2 | CO2 | | 3 | | 1 | 3 | 0 | 3 | 0 | | 0 | | 1 | | 2 | | | 0 | | | 0 | | 2 | | | **0** | | | **3** | | | **2** |
| 3 | CO3 | | 3 | | 1 | 3 | 0 | 3 | 0 | | 0 | | 1 | | 2 | | | 0 | | | 0 | | 2 | | | **0** | | | **3** | | | **2** |
| 4 | CO4 | | 3 | | 1 | 1 | 0 | 2 | 0 | | 0 | | 1 | | 0 | | | 0 | | | 0 | | 2 | | | **0** | | | **2** | | | **2** |
| 5 | CO5 | | 2 | | 0 | 3 | 0 | 1 | 2 | | 2 | | 1 | | 0 | | | 0 | | | 0 | | 2 | | | **0** | | | **3** | | | **2** |
| SYLLABUS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| No. | Content | | | | | | | | | | | | | | | | | | | | | | | Hours | | | | | | COs | | |
| I | **Introduction:**Historical developments in pavement design, Types of pavements, Road tests, Introduction to SHRP and NCHRP, Introduction to various methods of pavement design:Empirical, mechanistic and mechanistic empirical, Design factors: Traffic loading, Environment, Materials, Failure criteria and reliability. | | | | | | | | | | | | | | | | | | | | | | | **08** | | | | | | **CO1** | | |
| II | **Analysis and design of flexible pavements**:  Introduction to homogenous and layered elastic systems, underlying assumptions, Stresses and deflections in homogenous masses, Burmister’s 2 layer and 3-layer theories, Introduction to flexible pavement analysis using KENPAVE and IIT-PAVE, Design of flexible pavements as per AASHTO (1993), MEPDG and IRC 37:2018 | | | | | | | | | | | | | | | | | | | | | | | **10** | | | | | | **CO2** | | |
| III | **Analysis and design of rigid pavements**  Types of Stresses and Causes, Factors influencing Stresses in rigid pavements; Wheel Load Stresses, Warping Stresses, Friction Stresses, Types of Joints in Cement Concrete Pavements and their Functions, Joint Spacing, Design of Slab Thickness, Design of Joint Details for Longitudinal Joints, Contraction Joints and Expansion Joints, Design of rigid pavements as per IRC 58:2015 and AASHTO method, Analysis of rigid pavements in IITPAVE and KENPAVE | | | | | | | | | | | | | | | | | | | | | | | **08** | | | | | | **CO3, CO5** | | |
| IV | **Reliability:**  Introduction to reliability in pavement design, Variability in pavement input parameters, Probabilistic methods of pavement design, Statistical concepts, Incorporation of variability into pavement systems as per AASHTO and MEPDG procedures, introduction to Monte Carlo simulation and Rosenblueth method. | | | | | | | | | | | | | | | | | | | | | | | **05** | | | | | | **CO4** | | |
| V | **Drainage Design:**  General considerations in pavement drainage, Drainage materials and procedures, considerations and design of drainage in urban roads and highways as per Indian practices. | | | | | | | | | | | | | | | | | | | | | | | **05** | | | | | | **CO2** | | |
| Total Hours | | | | | | | | | | | | | | | | | | | | | | | | **36** | | | | | |  | | |
| **Essential Readings** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Yang H. Huang, “Pavement Analysis and Design”,Pearson | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Yoder E.J., and Witczak M.W, “Principles of Pavement Design”, John Willey & Sons. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Pavement Engineering: Principles and Practice, Second Edition | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Supplementary Readings** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Kandhal, P.S. “Bituminous Road Construction in India” PHI learning | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. MORT& H, “Specifications of Road and Bridge Works” | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Relevant IRC codes. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |