|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 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 | | | | | | | | | | **2019-20** | | | | | | |
| Department | | | | **Civil Engineering** | | | | | | | | | | | | | Semester | | | | | | | | | | **V** | | | | | | |
| Course  Code | | Course Name | | | | | | | | **Pre requisite** | | | | Credit Structure | | | | | | | | Marks Distribution | | | | | | | | | | | |
| L | | T | | | P | C | | INT | | | MID | | | END | | | | Total | |
| **CE 311** | | **Environmental Engineering – II** | | | | | | | | **Nil** | | | | **3** | | **0** | | | **0** | **3** | | **50** | | | **50** | | | **100** | | | | **200** | |
| Course  Objectives | | 1. To analyze the Waste water sources and waste water characteristics and to develop various waste water treatment process. | | | | | | | | | | Course Outcomes | | | | CO1 | | | Able to gain an experience in the implementation of environmental Engineering on engineering concepts which are applied in field. | | | | | | | | | | | | | | |
| 1. To train the students on developing practical, efficient and cost effective solutions on problems and challenges on environmental sciences and engineering. | | | | | | | | | | CO2 | | | Able to get a diverse knowledge of environmental engineering practices applied to real life problems. | | | | | | | | | | | | | | |
| 1. To give an experience in the implementation of engineering concepts which are applied in field of waste Water treatment process. | | | | | | | | | | CO3 | | | Able to learn to understand the theoretical and practical aspects of environmental engineering along with the design and management applications. | | | | | | | | | | | | | | |
| 1. To present the foundations of many basic Engineering tools and concepts related Environmental Engineering. | | | | | | | | | | CO4 | | | Able to identify environmental problems and solutions. | | | | | | | | | | | | | | |
|  | | | | | | | | | | CO5 | | | Able to designing various physico-chemical unit processes and operations to achieve the desired water quality in water and wastewater systems. | | | | | | | | | | | | | | |
| 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 | | 0 | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | | | 0 | | | 0 | | 0 | | | 0 | | | 3 | | | | 0 |
| 2 | CO2 | | 3 | | 0 | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | | | 0 | | | 0 | | 0 | | | 0 | | | 3 | | | | 0 |
| 3 | CO3 | | 3 | | 0 | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | | | 0 | | | 0 | | 0 | | | 0 | | | 3 | | | | 0 |
| 4 | CO4 | | 3 | | 0 | 0 | 0 | 0 | 0 | | 0 | | 0 | | 0 | | | 0 | | | 0 | | 0 | | | 0 | | | 3 | | | | 0 |
| 5 | CO5 | | 3 | | 0 | 1 | 0 | 0 | 0 | | 0 | | 0 | | 0 | | | 0 | | | 0 | | 0 | | | 0 | | | 3 | | | | 0 |
| SYLLABUS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| No. | Content | | | | | | | | | | | | | | | | | | | | | | | Hours | | | | | | | COs | | |
| I | **Sanitary Engineering**  Definition of sullage, sewage, sewerage, sewer, refuge, garbage, sewage treatment/Disposal system and waste water management. | | | | | | | | | | | | | | | | | | | | | | | **04** | | | | | | | **CO1, CO2, CO3** | | |
| II | **Sewage Systems, Collection and Conveyance**  Strength of Sewage, Sampling of Sewage to analyze for Physical, Chemical and Biological Parameters; Decomposition of sewage, comparison, Design of Sewer; Domestic and industrial sewage, volume of domestic sewage, variability of flow, limiting velocities-Self cleansing and Maximum velocities of sewer; Types of Sewers. | | | | | | | | | | | | | | | | | | | | | | | **06** | | | | | | | **CO3** | | |
| III | **Waste Water Flow**  Estimation of Dry Weather Flow and Storm Water, Variation of flow, Estimation of design discharge. | | | | | | | | | | | | | | | | | | | | | | | **04** | | | | | | | **CO3** | | |
| IV | **Waste Water Characteristics**  Physical, chemical, and Biological characteristics of sewage and wastewater, effluent standards | | | | | | | | | | | | | | | | | | | | | | | **04** | | | | | | | **CO4** | | |
| V | **Waste Water Disposal and Treatment**  Treatment Methods – Principles; Dilution, self-purification, Flow diagram of conventional sewage treatment plant, Primary treatment – screens, Grit Chambers, detritus tank, skimming tank, Type – III and Type – IV settling, Design of secondary sedimentation tank. Secondary treatment – Trickling fitters, Biological contractor, Activated sludge process, Sequencing Batch Reactor (SBR); Membrane Bioreactor (UASB); Waste Stabilization Ponds; oxidation pond and ditches, aerated lagoon; Tertiary Treatment of Sewage; Decentralised Sewage Treatment & Reuse. | | | | | | | | | | | | | | | | | | | | | | | **10** | | | | | | | **CO5** | | |
| VI | **Treatment and Disposal of Sludge**  Sludge characterization; Thickening; Design of gravity thickener; Aerobic and anaerobic digestion; Standard rate and High rate digester design; Biogas recovery; Sludge Conditioning and Dewatering; Sludge drying beds; Standards for Disposal Methods; dilution; Mass balance principle; Self purification of river; Oxygen sag curve. | | | | | | | | | | | | | | | | | | | | | | | **08** | | | | | | | **CO5** | | |
| **Total Hours** | | | | | | | | | | | | | | | | | | | | | | | | **36** | | | | | |  | | | |
| **Essential Readings** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Environmental Engineering, Peavy H. S., Rowe D. R. and George Tchobanoglous, McGraw-Hill International. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Water Supply and Sewerage, McGhee T. J ., McGraw-Hill Inc., | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Garg, S.K., "Environmental Engineering", Vol. 1 & II Khanna Publishers, New Delhi, 2005. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Supplementary Readings** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Introduction to Environmental Engineering, Davis M. L and Cornwell D. A McGraw-Hill, Inc. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Wastewater Engineering- Treatment and Reuse, Metcalf & Eddy (Revised by G. Tchobanoglous, F. L. Burton and H. D. Stensel), Tata McGraw Hill. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Chemistry for Environmental Engineers, Sawyer C. N., McCarty P. L and Parkin G. F., McGraw- Hill. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. APHA, Standard Methods Examination of Water and Wastewater, American Public Health Association, Washington DC, 1995. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Manual for water supply and treatment, Central Public Health & Environmental Engineering Organization, Ministry of Housing and Urban Development, Govt. of India, 1999. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |