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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 | | | | | | | | | | **VII** | | | | | | |
| Course  Code | | Course Name | | | | | | | | **Pre requisite** | | | | Credit Structure | | | | | | | | Marks Distribution | | | | | | | | | | | |
| L | | T | | | P | C | | INT | | | MID | | | END | | | | Total | |
| **CE415** | | **Ground water Hydrology** | | | | | | | | **Nil** | | | | **3** | | **0** | | | **0** | **3** | | **50** | | | **50** | | | **100** | | | | **200** | |
| Course  Objectives | | To develop the student’s knowledge on basics of ground water flow. | | | | | | | | | | Course Outcomes | | | | CO1 | | | Student will be able to understand the basics of ground water flow. | | | | | | | | | | | | | | |
| To provide some knowledge about ground water flow in different types of aquifers. | | | | | | | | | | CO2 | | | Student will be able to understand the concept of ground water movement. | | | | | | | | | | | | | | |
| To develop understanding of flows from wells. | | | | | | | | | | CO3 | | | Student will be able to compute flow from different types of aquifers. | | | | | | | | | | | | | | |
| To make the student understand about management of ground water. | | | | | | | | | | CO4 | | | Student will be able to understand the various processes of ground water management. | | | | | | | | | | | | | | |
| To provide knowledge about solute transport in ground water. | | | | | | | | | | CO5 | | | Student will be able to computesolute transport in ground water flow. | | | | | | | | | | | | | | |
|  | | | | | | | | | | 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** | **0** | **0** | **3** | **0** | | **0** | | **0** | | **0** | | | **0** | | | **0** | | **0** | | | **0** | | | **0** | | | | **3** |
| 3 | CO3 | | **3** | | **3** | **0** | **0** | **0** | **0** | | **0** | | **0** | | **0** | | | **0** | | | **0** | | **0** | | | **3** | | | **0** | | | | **3** |
| 4 | CO4 | | **3** | | **3** | **3** | **0** | **0** | **0** | | **3** | | **0** | | **0** | | | **0** | | | **0** | | **0** | | | **0** | | | **0** | | | | **3** |
| 5 | CO5 | | **3** | | **3** | **3** | **0** | **3** | **0** | | **0** | | **0** | | **0** | | | **0** | | | **0** | | **0** | | | **0** | | | **3** | | | | **3** |
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| SYLLABUS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| No. | Content | | | | | | | | | | | | | | | | | | | | | | | Hours | | | | | | | COs | | |
| I | **Introduction**  Definition of ground water, ground water balance equation, Continuum approach and representative elementary volume approach in ground water. | | | | | | | | | | | | | | | | | | | | | | | 06 | | | | | | | CO1 | | |
| II | **Ground water movement**  Darcy’s law and it’s extension, different types of aquifers, aquifer coefficients, Dupuit’s approximation, governing equations of ground water flow, ground water flow in confined aquifer, ground water flow in unconfined aquifer. | | | | | | | | | | | | | | | | | | | | | | | 08 | | | | | | | CO2 | | |
| III | **Well hydraulics**  Wells in confined and unconfined aquifers, steady flow from a well in confined aquifer, steady flow from a well in unconfined aquifer, solution of unsteady ground water flow in confined aquifer, solution of unsteady ground water flow in unconfined aquifer. | | | | | | | | | | | | | | | | | | | | | | | 08 | | | | | | | CO3 | | |
| IV | **Management of Ground water**  Introduction to ground water management models, management of potential aquifers, safe yield from aquifers, artificial recharge of aquifers, estimation of ground water recharge. | | | | | | | | | | | | | | | | | | | | | | | 08 | | | | | | | CO4 | | |
| V | **Ground water transport process**  Source of ground water contamination, solute transport in porous media, diffusion equation for distributed and continuous source, retardation of solutes. | | | | | | | | | | | | | | | | | | | | | | | 06 | | | | | | | CO5 | | |
| Total Hours | | | | | | | | | | | | | | | | | | | | | | | | **36** | | | | | |  | | | |
| **Essential Readings** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. D. K. Todd, “Groundwater Hydrology”, John Wiley & Sons, 3rdEdition, 2004. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. H. M.Raghunath, “Groundwater Hydrology”, John Wiley & Sons, 1stEdition, 1982. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. M Kasenow, Applied ground water hydrology and well hydraulics, Water Resources publication, 2nd edition, 2001 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Supplementary Readings** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. M. Akhbari, “Groundwater HydrologyEngineering, Planning, and Management”, CRC press, 1st Edition, 2011. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. K. R. Rushton, “Groundwater Hydrology: Conceptual and Computational Models”, John Wiley & Sons, 1stEdition, 2003. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. V C Agarwal Ground water hydrology, PHI, 1st edition, 2012 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |