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<tr><td>Course title</td><td colspan="8">Contaminant Transport Modelling</td><td>Course No</td><td colspan="4">CE5480</td></tr>
<tr><td rowspan="2">Department</td><td rowspan="2">Civil Engineering</td><td rowspan="2">New Credits</td><td>L</td><td>T</td><td>E</td><td>P</td><td>O</td><td>C</td><td rowspan="2">Old Credits</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td></td><td></td><td></td><td>6</td><td>9</td><td>3</td><td></td><td></td><td>3</td></tr>
<tr><td>Offered for</td><td colspan="8">M.Tech, M.S., PhD</td><td>Status</td><td colspan="4">Modified</td></tr>
<tr><td>Faculty</td><td colspan="8">B.S. Murty</td><td>Type</td><td colspan="4">M.Tech. Core</td></tr>
<tr><td>Pre-requisite</td><td colspan="8">None</td><td>To take effect from</td><td colspan="4">Jan 2021</td></tr>
<tr><td colspan="13">Description: 1) Formulate a mathematical model from a physical conceptualization of a real-world ground water and surface water contamination scenario and explicitly stating the different model assumptions. 2) Apply numerical techniques and/or software packages to solve the mathematical model, check for stability, consistency, and convergence, and perform model calibration where necessary. 3) Interpret model results to predict contaminant movement for environmental control and remediation.

Course Contents: Introduction: Transport phenomenon, diffusion, dispersion, advection, adsorption, conservative and non-conservative pollutants, sources and sinks (point and non-point). Model Formulation-I: Derivation of governing equations for flow and transport in surface and subsurface waters, chemical and biological process models, simplified models for groundwater (unsaturated, and saturated), lakes, streams, and estuaries. Model Formulation-II: Model complexity, selection and development, model resolution, coupled and uncoupled models, linear and nonlinear models, model calibration, application and evaluation of environmental control, and bio-remediation. Numerical techniques: 1D and 2D partial differential equations, Finite difference methods, Finite element methods and Finite volume methods, explicit, implicit, and mixed methods, numerical errors, consistency, stability, and convergence, coupled and uncoupled models, , high resolution techniques, multi-dimensional methods. Software packages: Stream quality modelling using QUAL2E/QUAL2K/WASP. Groundwater transport modelling using SUTRA, groundwater quality modeling using MODFlow, MT3D, RT3D.

Text Books: NIL

Reference Books : 1) Applied Contaminant Transport Modeling by Chunmiao Zheng, and Gorgon D. Bennet, second edition (February 5, 2002), Wiley-Interscience; ISBN-10: 0471384771; ISBN-13: 978-0471384779 2) Surface water quality modeling by Steven C. Chapra, (1 October, 1996), McGraw-Hill Science/Engineering/Math; ISBN-10: 0070113645; ISBN-13: 978-0070113640 3) Numerical methods for engineers by Steven C. Chapra and Raymond P. Canale, Seventh edition (1 August 2016), McGraw Hill Education India Private Limited; ISBN-10: 9352602137, ISBN-13: 978-9352602131 4) Numerical methods for fluid dynamics: With Applications to Geophysics by Dale R. Durran, Second edition (23 September 2010), Springer-Verlag New York Inc, ISBN-10: 1441964118, ISBN-13: 978-1441964113 5) Numerical methods for engineers and scientists by Joe D. Hoffman, International edition (1993), McGraw Hill International Editions, ISBN-10: 9780824704438, ISBN-13: 978-0824704438</td></tr>
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