Course syllabus

Department of Civil Engineering, Indian Institute of Technology Madras

CE5480-Hydroinformatics Lab

Credit Distribution C:6 L:1 T:0 P:3 E:0 O:2 TH:

Course Type: Lab

Description: Course Objectives: The primary objective of the course is to give students ample hands-on opportunity to work with Geographic Information System (GIS) and hydrosystems simulation models using example datasets from real-world problems. Expected Outcomes: In this course the students will: 1. learn to describe the fundamental concepts of geographic information systems (GIS), 2. gain hands-on-experience in Quantum GIS (open source GIS software) that is being widely used for analysing and processing geo-spatial data 3. understand various geo-spatial analysis tools relevant for water resources engineering 4. gain hands-on experience in using hydrosystems simulation models

Course Content : Course Contents: Geographic Information System: (30%) Components of GIS, Raster and vector data models, Scale, Projection, Datum and Coordinate system, Data acquisition and conversion techniques, Elements of map making (Cartography). Database management System, Query development, Spatial querying, Geoprocessing, Advanced Geostatistical tools: variogram and krigging, topography in GIS (contours, DEM and TIN) DEM analysis (Line of sight and viewshed), Watershed delineation, Displaying GIS data in google earth Hydrosystem simulation models: (70%) [Each student will be asked to choose two models from the following for a detailed study] 1. Watershed Simulation: HEC-HMS, SWAT 2. Reservoir operation: HEC-ResSIM 3. Design of water distribution system: EPANET 4. Water surface profile computation: HEC-RAS 5. Storm drainage design, Detention basin design: SWMM 6. Groundwater flow simulation: MODFLOW 7. Irrigation water management: AQUACROP 8. Water Resources Planning: WEAP 9. Unsaturated flow and transport: HYDRUS 10. Free surface flow: TELEMAC-2D

Text Books NIL

Reference Books :

- 1. Longley, Paul A., M. F. Goodchild, D. J. Maguire, and D. W. Rhind. 2005. Geographic Information Systems and Science, 2nd Ed., Wiley, 536 pages
- 2. QGIS training material - https://qgis.org/en/site/forusers/trainingmaterial/index.html
- 3. HEC-HMS: Hydrologic Engineering Centres " Hydrologic Modelling System http://www.hec.usace.army.mil/software/hec-hms/
- 4. HEC-RAS: Hydrologic Engineering Centres " River Analysis System
- http://www.hec.usace.army.mil/software/hec-ras/ 5
- . HEC-ResSIM:Hydrologic Engineering Centres Reservoir System Simulation
- http://www.hec.usace.army.mil/software/hec-ressim/
- 6. SWMM: Storm Water Management Model
- http://www2.epa.gov/water-research/storm-water-management-model-swmm
- 7. SWAT: Soil and Water Assessment Tool http://swat.tamu.edu/

- 8. EPANET: Hydraulic modelling of water distribution piping system http://www2.epa.gov/water-research/epanet
- 9. MODFLOW: Finite difference ground water modelling system of USGS http://water.usgs.gov/ogw/modflow/
- 10. AQUACROP: FAO crop model for assessment of irrigation water requirement http://www.fao.org/nr/water/aquacrop.html
- 11. WEAP: Water Evaluation and Planning System http://www.weap21.org/
- 12. HYDRUS: Modeling environment for analysis of water flow and solute transport in variably saturated porous media. http://www.ars.usda.gov/Main/docs.htm?docid=8921
- 13. TELEMAC-2D: Two-dimensional hydrodynamic model to Simulate free-surface flows http://www.opentelemac.org/index.php/presentation?id=17

Prerequisite: NIL