

HWRM-307 HYDRO INFORMATICS

(02 credit hrs)

PRE-REQUISITE: GICT-201

LEARNING OUTCOMES

Following are the learning outcomes of the course:

- Student will learn about Data and the Data Life Cycle
- Student will learn about Databases and Data Models
- Student will learn about Visualization, Transformations, Analysis, and Modeling
- Student will learn about Soft Computing

CONTENTS

Unit-1 Data and the Data Life Cycle

- 1.1. Describe the data life cycle
- 1.2. Determine the dimensionality of a dataset, including the scale triplet of support, spacing and extent
- 1.3. Create basic programs for data collection using data loggers and, environmental sensors
- 1.4. Generate metadata and describe datasets to support data sharing
- 1.5. Discover and access data from major data sources

Unit-II Databases and Data Models

- 2.1. Store, retrieve, and use data from important data models used in Hydrology such as, ArcHydro, NetCDF, and the Observations Data Model (ODM)
- 2.2. Develop data models to represent, organize, and store data
- 2.3. Design and use relational databases to organize, store, and manipulate data
- 2.4. Query, aggregate, and pivot data using Structured Query Language (SQL), Excel, R, and other software systems

Unit-III: Visualization, Transformations, Analysis, and Modeling

- 3.1. Create reproducible data visualizations
- 3.2. Write and execute computer code to automate difficult and repetitive data related tasks manipulate data and transform it across file systems, flat files, databases, programming languages, etc.
- 3.3. Retrieve and use data from Web services
- 3.4. Organize data in a variety of platforms and systems common in hydrology and engineering

Unit-IV: Soft Computing

- 4.1. Soft computing,
- 4.2. Data mining
- 4.3. Artificial neural network
- 4.4. Genetic algorithms
- 4.5. Fuzzy logics

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

ASSIGNMENTS – TYPE AND NUMBER WITH CALENDAR

It is continuous assessment. The weightage of Assignments will be 25% before and after midterm assessment. It includes:

- classroom participation,
- attendance, assignments and presentation,
- homework
- attitude and behavior,
- hands-on-activities,
- short tests, quizzes etc.

ASSESSMENT AND EXAMINATIONS:

Sr. No.	Elements	Weightage	Details
1.	Mid Term Assessment	35%	It takes place at the mid-point of the semester
2.	Formative Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentation, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

RECOMMENDED TEXT BOOKS / SUGGESTED READINGS

1. Kumar, P. (2005), *Hydroinformatics: Data Integrative Approaches in Computation, Analysis, and Modeling*, CRC Press, 552 p.
2. Grayson, R. and Blöschl, G. (2000), *Spatial Patterns in Catchment Hydrology: Observations and Modelling*, Cambridge University Press, Cambridge.
3. Tomer, S.K. (2012), *Python in Hydrology*, Green Tea Press, Indian Institute of Science, 147p. Full PDF text available at <http://www.greenteapress.com/pythonhydro/pythonhydro.html> (Links to an external site.)

HWRM-307: HYDRO INFORMATICS (LAB)

(01 Credit hr)

PRE-REQUISITE: GICT-201

LEARNING OUTCOMES

Following are the learning outcomes of the course:

- Student will learn about Data and the Data Life Cycle
- Student will learn about Databases and Data Models
- Student will learn about Visualization, Transformations, Analysis, and Modeling
- Student will learn about Soft Computing

CONTENTS

Unit-1 Data and the Data Life Cycle

- 1.1. Practical Skills related to data management and life cycle assessment

Unit-II Databases and Data Models

- 2.1. Practical related to Database and Data Models

Unit-III: Visualization, Transformations, Analysis, and Modeling

- 3.1. Data Transformation and Modeling
- 3.2. Data models common in hydrology and engineering

Unit-IV: Soft Computing

- 4.1. Soft computing,
- 4.2. Data mining
- 4.3. Artificial neural network
- 4.4. Genetic algorithms
- 4.5. Fuzzy logics

TEACHING – LEARNING STRATEGIES

- Lecture based examination
- Presentation/seminars
- Class discussion
- Quizzes

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