HYDROLOGY AND AGRICULTURAL METEOROLOGY

ENAE 301

Lecture : 3 **Year : III**
Tutorial : 1 **Part : I**
Practical : 2

Course Objectives:
The objective of this course is to provide concept of hydrological processes; equip students with skills in instrumentation, data recording, and analytical techniques; develop proficiency in computational analysis for the design and management of water resources projects; and familiarize students with the agricultural meteorology.

1 Introduction (2 hours)

1.1 Scope and application of weather and hydrology in engineering
1.2 Hydrological cycle and water balance equation
1.3 Atmospheric water system
1.4 Hydro-meteorological development in Nepal
1.5 Concept of citizen science for hydro-meteorological observation

2 Agricultural Meteorology (8 hours)

2.1 Scope and application of agricultural meteorology
2.2 Wind and its types (Cyclone, anticyclone, land breeze and sea breeze)
2.3 Atmospheric temperature and humidity; concept of saturation; vapor pressure; process of condensation
2.4 Formation of dew, fog, mist, frost and cloud
2.5 Monsoon mechanism and importance in Nepalese agriculture
2.6 Weather hazards-drought, floods, frost, tropical cyclones and extreme weather conditions such as heat wave and cold wave
2.7 Agriculture and weather relations

3 Precipitation (6 hours)

3.1 Causes and forms of precipitation
3.2 Measurement and presentation of rainfall data
3.3 Estimation of missing rainfall data
3.4 Test of consistency of rainfall data (Double mass curve)
3.5 Intensity duration frequency(IDF) and depth area duration (DAD) curves

4 Hydrologic Abstractions (6 hours)

4.1 Interception and depression storage
4.2 Actual evapotranspiration (AET) and potential evapotranspiration (PET)

4.3 Factors affecting, measurement and estimation of evaporation and transpiration
4.4 Infiltration: Factors affecting and measurement; Tools, techniques, empirical and analytical models for estimation

5 Runoff and Stream Flow (6 hours)

5.1 Methods of measurement of velocity and discharge
5.2 Methods of measurement of stage and stage-discharge relationship
5.3 Runoff characteristics of streams and rainfall-runoff relationship
5.4 Estimation of runoff and annual yield of a basin
5.5 Flow duration and flow mass curves

6 Hydrograph (6 hours)

6.1 Concept and components of hydrograph
6.2 Factors affecting flood hydrograph
6.3 Base flow separation and effective rainfall
6.4 Unit hydrograph: Synthetic and instantaneous unit hydrographs
6.5 Derivation of unit hydrograph and runoff hydrograph

7 Flood Hydrology (5 hours)

7.1 Concept of design flood
7.2 Frequency and probability concepts
7.3 Frequency distribution functions and their application: Normal, Log-normal, Gumbel and Log-Pearson Type III distributions
7.4 Flood prediction by rational and empirical methods

8 Flood Routing (6 hours)

8.1 Basic equation and method of flood routing
8.2 Hydraulic channel routing
8.3 Clark method for instantaneous unit hydrograph (IUH)
8.4 Nash conceptual model

Tutorial (15 hours)

1. Areal averaging of rainfall by different methods
2. Estimation of missing rainfall data
3. Analysis of mass curve
4. Construction of IDF and DAD curves
5. Frequency analysis of rainfall and determination of return period
6. Estimation of runoff using empirical methods
7. Estimation of flood using empirical methods
8. Hydrograph analysis and derivation of unit hydrographs
9. Stream channel routing by different methods
10. Derivation of IUH using Clark's method

Practical **(30 hours)**

1. Individual catchment delineation using topo map, Google earth and GIS
2. Hydrological assessment of the catchment using real data and empirical methods
3. Video presentation and observation of meteorological instruments
4. Video presentation and discharge measurements by current meter, salt dilution and float methods
5. Measurement of infiltration and percolation rates by double ring infiltrometer and determination of infiltration indices
6. Rainfall-runoff simulation

Final Exam

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Hours	Marks distribution*
1	2	4
2	8	10
3	6	8
4	6	8
5	6	8
6	6	8
7	5	8
8	6	8
Total	**45**	**60**

* There may be minor deviation in marks distribution.

References

1. Subramanya, K. (2018), Engineering Hydrology (4th Edition). New Delhi, McGraw Hill Education (India) Pvt. Ltd. Chennai.
2. Dulal, K. N., Baral, S. (2012). Engineering hydrology. Apex Educational Academy.
3. Chow, V. T., Maidment, D. R., Mays, L. W. (1988). Applied hydrology (Latest Edition). McGraw-Hill.
4. Plate, E. J. (1982). Engineering meteorology. Amsterdam: Elsevier Scientific Publishing Company.
5. Varshney, R. S. (2012). Engineering hydrology. Nem Chand and Bros.
6. Linsley, R. K., Kohler, M. A., Paulhus, J. L. (1982). Hydrology for engineers (Latest Edition). McGraw-Hill International Co.
7. Jha, P.C., Devkota, N. (2024), Irrigation and Drainage Engineering (3rd Edition). Heritage Publishers and Distributors, Kathmandu