Water Resources and Irrigation Engineering
EG 3204 CE

Year: III **Total: 8 Hrs. /week**
Semester: II **Lecture: 4 Hrs./week**
Tutorial: 2 Hrs./week
Practical: 2 Hrs./week
Lab: Hr./week

Course Description:
This course focuses the development and management of water resources and irrigation and its systems in general.

Course Objectives:
After completion of this course students will be able to:

1. Estimate irrigation water requirements;
2. Measure stream flow discharge;
3. Estimate monthly flows at intake;
4. Design canals based on soil type;
5. Identify suitable irrigation methods based on topography, crop and water source and
6. Explain the function, operation and maintenance of irrigation structures.
7. General knowledge of Micro Hydropower Plant (MHP)

Unit 1: Introduction to Water Resources and Irrigation Engineering. [3 Hrs.]

1.1 Definition, Need and objectives of irrigation
1.2 Advantages and disadvantages of irrigation
1.3 Sources of irrigation water and types of irrigation system
1.4 History and future scope of irrigation in Nepal

Unit 2: Crop Water and Irrigation Water Requirements: [8 Hrs.]

2.1 Types and season of crops
2.2 Base and crop periods
2.3 Duty, Delta and their relation
2.4 Commanded areas (gross, net and irrigable)
2.5 Soil moisture contents and irrigation intensity interval
2.6 Water requirement of different crops
2.7 Irrigation water requirement considering losses, land preparation and effective rainfall

Unit 3: Introduction to engineering hydrology [10 Hrs.]

3.1 Engineering hydrology and Hydrological cycle
3.2 Causes, form and types of precipitation
3.3 Hydrological losses: interception, depression storage, evaporation, evapotranspiration, infiltration
3.4 Occurrence and distribution of rainfall in Nepal (Surface and ground waters)
3.5 Catchment area and runoff generation (factors affecting runoff)
3.6 Rain gauges and stream gauges (Gauge types and data presentation)
3.7 Stream flow measurement by velocity area method (Floats and Current meters)
3.8 Rainfall-runoff relationship
3.9 Long term monthly flows at gauged and un-gauged locations
3.10 Hydrograph: Definition, types

3.11 Unit Hydrograph

Unit 4: Methods of Irrigation: [5 Hrs.]

4.1 Surface irrigation (Free flooding, Border strip, Check, Basin and Zigzag methods)
4.2 Subsurface irrigation
4.3 Sprinkler irrigation
4.4 Drip or Trickle irrigation

Unit 5: Diversion Head Works: [8 Hrs.]

5.1 Layout, components and their functions
5.2 Weir and Barrage systems
5.3 Silt control by under sluices at head works (still pond regulation and continuous flushing)
5.4 Silt excluder and sediment ejector
5.5 Head regulator

Unit 6: Canal Irrigation: [8 Hrs.]

6.1 Classification of canals
6.2 Components of canal system
6.3 Alignment of canals
6.4 Sediment transport in canal
6.5 Design of alluvial canals (Lacey's and Kennedy's theories)
6.6 Design of non-alluvial canals (Manning's and Chezy's Formulae)
6.7 Seepage of canals and lining
6.8 Canal standards

Unit 7: Irrigation Structures: [8 Hrs.]

7.1 Cross-drainages
7.2 Drops or Falls
7.3 Head and Cross regulators
7.4 Escapes
7.5 Outlets

Unit 8: Water Logging and Drainage: [5 Hrs.]

8.1 Causes, effects and preventive measures of water logging
8.2 Need and importance of drainage
8.3 Surface and subsurface drainage systems

Unit 9: Irrigation Management: [3 Hrs.]

9.1 Operation and maintenance of irrigation works
9.2 Institutional development of irrigation systems

Unit 10: Micro Hydropower Plant (MHP): [2 Hrs.]

10.1 Introduction, scope and applications of MHP
10.2 Advantages, disadvantages and applicability of MHP
10.3 Policy of MHP development in Nepal
10.4 General layout of basic components of MHP

Tutorials: **[30 Hrs.]**

1. Chapter 2: Computation of Duty-Delta relation, soil moisture content, irrigation interval and water requirement for crops **(6 Hrs.)**
2. Chapter 3: Estimation of Hydrological losses, Estimation of long-term monthly flows in river at intake, canal design discharge, analyze the unit hydrograph **(15 Hrs.)**
3. Chapter 6: Design of canals based on theory of Lacey, Kennedy, Chezy and Manning **(9 Hrs.)**

Practical **[30 Hrs.]**

1. Conduct Field visit at meteorological station and prepare report and present.
2. Stream flow measurement by velocity area method
3. Estimate irrigation water requirement by CROPWAT software

References:

1. Irrigation Engineering and Hydraulic Structures, S K Garg, Delhi, 1983
2. Irrigation Engineering, Gurcharan Singh
3. Fundamentals of Irrigation Engineering, Bharat Singh, Nem Chand and Bros, Roorkee, 1983
4. Theory and design of irrigation structures, volume I and II, R S Varshney, S C Gupta and R L Gupta, Nem Chand and Bros., Roorkee, 1979
5. Engineering Hydrology by K. Subramanya, Tata-McGraw Hill Publishing Co., New Delhi.
6. Engineering Hydrology by B. L. Cupta, Standard Publishers and Distributors, New Delhi.
7. Engineering Hydrologu by Dr. KN Dulal and Sanjeeb Baral, APEX Educationla Academy, Putalisadak, Kathmandu.
8. Garg S K, "lrrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi

Evaluation Scheme:

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

Unit	Title	Hrs. (L+T)	Marks Distribution
1	Introduction to Water Resources and Irrigation Engineering	3+0=3	4
2	Crop Water and Irrigation Water Requirements	8+6=14	12
3	Introduction to engineering hydrology	10+15=25	20
4	Methods of Irrigation	5+0=5	4
5	Diversion Head Works	8+0=8	8
6	Canal Irrigation	8+9=17	12
7	Irrigation Structures	8+0=8	8
8	Water Logging and Drainage	5+0=5	4
9	Irrigation Management	3+0=3	4
10	Micro Hydropower Plant (MHP)	2+0=2	4
	Total	**90 Hrs]**	**80**