Water Supply Engineering
EG 2205 CE

Year: II **Total: 6 Hrs. /week**
Semester: II **Lecture: 4 Hrs. /week**
Tutorial: 1 Hr./week
Practical: Hrs./week
Lab:2/2 Hrs./week

Course Description:
This course focuses on familiarization of fundamental of water supply engineering terminology, principle, system management, different component of w/s design and construction.

Course Objectives:
After the completion of this course, students will be able to:
1. Assess the various water consumption categories;
2. Describe the sources and methods of water collection;
3. Explain and illustrate water transmission and distribution systems;
4. Describe and illustrate pipe fittings, valves accessories and layout;
5. Carry out qualitative and quantitative analysis of water;
6. Explain the process of the water treatment
7. Outline and sketch the water treatment process.

Course Contents:

Theory

Unit 1:Water supply: **[3 Hrs.]**
- 1.1 Introduction
- 1.2 Importance and necessity of planned water supply system
- 1.3 History of planned water supply system in Nepal
- 1.4 Impact of water supply
  - 1.4.1 Positive Impact-long term and short-term impact
  - 1.4.2 Negative Impact
- 1.5 Water supply and its impact on public health, women, and environment
- 1.6 Components of water supply system (Rural and Urban) and their function

Unit 2:Sources of Water Supply: **[6 Hrs.]**
- 2.1 Hydrological Cycle and sources of water
- 2.2 Surface Sources: River, Streams, Pond, Lake, Impounded reservoir
- 2.3 Ground Sources: Springs – gravity and artesian, Wells – shallow, deep, artesian and tube wells, Infiltration galleries and wells
- 2.4 Introduction to alternative Sources of water: Rain Water Harvesting, Conservation Pond, fog collection
- 2.5 Conservation and protection of water sources
- 2.6 Selection and measurement of water sources

Unit 3:Quantity of Water: **[6 Hrs.]**
- 3.1 Water demand:
  - 3.2.1 Domestic demand
  - 3.2.2 Livestock demand
  - 3.3.3 Commercial demand
  - 3.3.4 Public/municipal demand

3.3.5 Industrial demand
3.3.6 Firefighting demand
3.3.7 Loss and wastage
3.3.8 Total water demand

3.2 Water supply project: Definition, Design period, factors affecting design period, project selection criteria

3.3 Population forecasting: necessity and methods
3.4.1 Arithmetical increase method
3.4.2 Geometrical increase method
3.4.3 Incremental increase method
3.4.4 Numerical on population forecasting and water demands

3.4 Variation in demand of water: types of variation, average demand, peak demand, peak factor, factors affecting demand of water, socio-economic factors affecting demand of water

Unit 4:Intake: [4 Hrs.]

4.1. Definition and Classification of intake
4.2. Characteristics
4.4.1 River intake
4.4.2 Reservoir intake
4.4.3 Spring Intake
4.3. Site selection and protection measures for intake works

Unit 5:Quality of Water: [6 Hrs.]

5.1. Pure and impure water
5.2. Potable and wholesome water
5.3. Polluted and contaminated water
5.4. Impurities in water: classification and effects
5.4.1 Suspended impurities
5.4.2 Colloidal impurities
5.4.3 Dissolved impurities
5.5. Hardness in water, types of hardness, alkalinity in water
5.6. Living organisms in water: virus, algae, worms and bacteria
5.7. Water related diseases: water borne, water washed, water based and water vector, transmission routes and preventive measures
5.8. Water quality standard for drinking purpose (WHO, GoN)
5.9. Water sampling and storing
5.10. Physical analysis (temperature, colour, turbidity, taste and odour)
5.11. Chemical analysis (total solids, pH, chlorine)

Unit 6:Treatment of Water: [16 Hrs.]

6.1. Objectives of water treatment
6.2. Screening: -Purpose, coarse and fine screens
6.3. Plain Sedimentation: - purpose, types of sedimentation tank, ideal sedimentation tank
6.4. Sedimentation with coagulation
6.4.1 Purpose
6.4.2 Process
6.4.3 Coagulants (types and their chemical reactions)
6.4.4 Flocculation tanks

6.4.5 Clarifier

6.5. Filtration
- 6.5.1 Purpose
- 6.5.2 Theory of filtration
- 6.5.3 Types of filters and its operation and maintenance
  - 6.5.3.1 Slow sand filter
  - 6.5.3.2 Rapid sand filter
  - 6.5.3.3 Pressure filter

6.6. Disinfection: purpose, methods of disinfection-boiling, ultra violet ray, ozone treatment, electro catadyne, sodish.

6.7. Chlorination: chlorine dose, residual chlorine, contact time, forms of chlorination - plain chlorination, break point chlorination, super chlorination and de-chlorination, factors affecting chlorination

6.8. Softening: purpose, removal of temporary hardness by boiling and lime treatment, removal of permanent hardness by lime soda, zeolite process

6.9. Miscellaneous treatments: aeration methods, removal of iron and manganese, domestic purification process

Unit 7:Reservoirs and Distribution System: [4 Hrs.]

7.1. Water storage (Reservoir): clear water reservoir, service reservoir

7.2. Distribution system: gravity, pumping, and dual system

7.3. Introduction to Ferrocement tank

7.4. Layout of distribution system: dead end, grid iron, ring and radial system

7.5. System of supply: continuous and intermittent system

Unit 8:Gravity Water Supply System: [4 Hrs.]

8.1. Concept of gravity water supply

8.2. Schematic diagram of a typical gravity water supply system

8.3. Hydraulic grade line

8.4. Break pressure tank

8.5. Public tap stand post

8.6. Residual head requirement

8.7. Numerical examples of pipeline design

Unit 9:Conveyance of Water: [4 Hrs.]

9.1. Types of pipe: CI, GI, steel, PVC, polythene, PPR pipes

9.2. Laying procedure of pipes

9.3. Pipe joints–Purpose, Types-socket and spigot, flanged, expansion, collar and screwed socket joints

9.4. Testing of pipe joints (leakage test)

Unit 10: Valves and Fittings: [4 Hrs.]

10.1. Valves- Purpose, Types-sluice, reflux, air and drain valves, Meter, Globe, Ball, Safety, Gate.

10.2. Fittings-Purpose, Types-stop cocks, water taps, bends, reducers, tees, socket, elbow, union, cross, wash basin, shower, sink

10.3. Operation and Maintenance-Necessity, Methods-regular and emergency.

Unit 11: Water supply in Emergency Situation: **[3 Hrs.]**

11.1. Introduction: Sphere Guidelines
11.2. Quantity of water required in emergencies
11.3. Cleaning and disinfecting water sources, tanker, pot/utensils
11.4. Rehabilitation of small-scale piped water distribution systems, water treatment works after an emergency
11.5. Emergency treatment of drinking-water at the point of use

Tutorials: **[15 Hrs.]**

1. **Introduction** **[1 Hr.]**
   Schematic diagrams of typical Urban and Rural water supply systems

2. **Quantity of Water** **[4 Hrs.]**
   Numerical on population forecasting by Arithmetical increase Method, Geometrical increase Method, incremental increase Method, Numerical on determination of water demands of a community

3. **Intakes** **[1 Hr.]**
   Typical figures of River, Reservoir and spring intakes

4. **Treatment of water** **[3 Hrs.]**
   Typical figure of sedimentation tank, Filtration-slow and rapid sand filter

5. **Reservoirs and Distribution System** **[1 Hr.]**
   Layout of distribution system: dead end, grid iron, ring and radial system, ferrocement tank

6. **Gravity Water Supply System:** **[3 Hrs.]**
   Schematic diagram of a typical gravity water supply system, Break pressure tank Public tap stand post, Numerical examples of Pipeline design

7. **Conveyance of Water** **[1 Hr.]**
   Typical figures of pipe joints

8. **Valves and Fittings** **[1 Hr.]**
   Typical figures of valves

Practical

1. Determine physical parameters (Colour, Turbidity, Temperature)
2. Determine pH value
3. Perform jar test
4. Determine total solids
5. Determine dissolved oxygen

Text books:

1. S.K. Neupane, *"Water Supply Engineering*", Bhunipuran Prakashan, Bagbazar, Kathmandu.

References:

1. Birdie, G.S. and Birdie, J.S, Water Supply and Sanitary Engineering, Dhanapat Rai & Sons Publishers, NaiSarak, Delhi- 110006, India.

2. Dr. Punmia B C, Jain A, and Jain, A, Water Supply Engineering, Laxmi Publications (P) Ltd, New Delhi
3. Barry, R, The Construction of Building (Volume 4) Building Services, Affiliated East- west Press Pvt. Ltd., New Delhi

Evaluation Scheme

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

Unit	Title	Hrs.	Marks distribution*
1	Water supply	4	4
2	Sources of Water Supply	6	8
3	Quantity of Water	10	12
4	Intake	5	4
5	Quality of Water	6	8
6	Treatment of Water	19	20
7	Reservoir and Distribution System	5	4
8	Gravity Water Supply System	7	8
9	Conveyance of Water	5	4
10	Valves and Fittings	5	4
11	Water supply in Emergency Situation	3	4
		75	80

*There may be minor variation in marks distribution.

The questions setting should be in the multiplication of 4.