

द्वितीय पत्र :- प्राविधिक विषय

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 - 2.2.2 Municipal Wastewater treatment facility
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1. **Concept and principles.**

1.1 Drinking Water.

- Present status of Water Supply and Sanitation
- Current issues and problems of Water Supply in rural and urban
- Design norms and principles
- Principles related to unit operation:-
 - a) Aeration.
 - b) Flocculation and coagulation.
 - c) Sedimentation process including coarse material removal.
 - d) Filtration process/Slow sand filtration /Rapid filtration.
 - e) Disinfection process.
 - f) Sludge handling and disposal.

1.2 Municipal Wastewater.

Principles related to unit operation:-

- a) Physical treatment: Screen /Grit chamber /Gas chamber /Mixing /Sedimentation /Flocculation /Floatation etc.
- b) Chemical treatment: Chemical precipitation, Absorption, Ion exchange, Electrolysis etc.
- c) Biological treatment: Aerobic and Anaerobic process- Aerated lagoons, Activated sludge, Trickling filters, Oxidation ditches.
- d) Sludge treatment: Drying, Dewatering, Filtration, Centrifugation, Chemical conditioning (immobilization), and Incineration

1.3 Industrial wastewater.

Introduction to nature and origin of industrial wastewater and their impacts on aquatic environment, flow characteristic, effluent and stream standards, Waste water treatment processes.

Pre and primary treatment: Equalization, Neutralization, Sedimentation oil separation, Filtration etc.

Wastewater treatment techniques: Coagulation and precipitation, Biological treatment (aerated lagoons, conventional activated sludge, trickling filters), Absorption, Ion exchange, Chemical oxidation.

Tertiary treatment for major polluting industries (tannery, textile, pulp and paper, sugar etc).

Sludge treatment, handling and disposal.

2. **Design and Treatment:-**

2.1 Design of the system

2.1.1 Drinking Water supply system

Introduction to pollutants (sources, types and effects), sources and characteristics of water, water demand and quantity, estimation of future population, design period.

Water sources and intakes.

Design of intake structures for rural and urban water supply system.

Pipeline design: design criteria, design of transmission and distribution system (including pipe networks).

Reservoirs: types, size determination.

2.1.2 Municipal Wastewater system.

Sources and nature of wastewater, effluent characteristics.

Estimation of quantity of sanitary sewage and storm water sewage collection systems, sewers design criteria.

Design of sanitary and storm water sewers and combined sewer systems.

Sewer Appurtenances: Manholes, Inverted siphons, House connections, Storm water inlets and etc.

2.1.3 Industrial Wastewater system

Industrial wastewater characteristics.

Concept of Central effluent treatment plant – Advantages and disadvantages.

Design criteria for Industrial Waste water system.

Design of Pre and primary treatment facilities: Equalization tank, Neutralization, Sedimentation oil separation, Filtration etc.

2.2 Design of treatment facility:-

2.2.1 Drinking Water treatment facility

Design of pre-treatment facility: Intake screen, aeration and etc.

Design of treatment facilities: Sedimentation, Flocculation, Filtration systems and Disinfection.

Advanced treatment: Absorption by activated carbon, ion exchange, multimedia filtration, ultra filtration and reverse osmosis, ozonation, ultra violet disinfection, demineralization, new development in water treatment operation.

2.2.2 Municipal wastewater treatment facility

Design of primary treatment: Screen, grit chamber, primary sedimentation, flow measurement facilities.

Design of secondary treatment: BOD removal, design criteria, activated sludge oxidation ponds /ditches, lagoons, trickling filters, and secondary clarifier.

Need for Tertiary treatment.

2.2.3 Industrial Wastewater treatment facility

Design of Industrial Wastewater treatment facilities: Coagulation and precipitation, Biological treatment (aerated lagoons, conventional activated sludge, trickling filters), Absorption, Ion exchange, Chemical oxidation.

Concept of Central effluent treatment plant – Advantages and disadvantages.

2.3 Management and other related aspects:-

2.3.1 Drinking Water system and treatment facility

Pipe materials and related aspects.

Sludge management, handling and disposal.

Operation and Maintenance of Water system.

Legal and Management aspects of Water system.

Financial aspects: Tariff structure, tariff rates and affordability, System cost recovery.

Education and training.

2.3.2 Municipal Wastewater system and treatment facility

Sludge management, handling and disposal.

Operation and Maintenance

Legal and Management aspects

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Legal and Management aspects

Financial aspects

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3 Ground water development.

3.1 Ground water flow.

Ground water occurrences and prospecting, chemical characteristics and
properties of ground water.

Ground water exploration and Methods of ground water withdrawal.

3.2 Ground water recovery and tube well design

Ground water recovery.

Tube well design.

3.3 Ground water quality

Ground water treatment (aerator, iron removal plant) requirement based on
ground water quality

Disinfecting wells and piping

Maintaining well yield

Sanitary protection for ground water supplies

Conservation and utility of ground water

4 Water and Wastewater quality issues

Introduction – Water resources and ecosystem, water cycle, fresh water and
competitive use of water.

Water pollution: Types and sources of water pollution, point and non-point
pollution sources, effects of pollution (river, lake and reservoir), pollution of
ground water.

Water quality and standards for various uses of water.

Sources and nature of Municipal and Industrial Wastewater, required effluent
quality and standards.

Municipal and Industrial wastewater quality and standards and its impact on
aquatic environment, effluent and stream standards.

Management: Strategies for water pollution control, water quality monitoring
and surveillance.

5 Environmental issues.

5.1 Environmental health and sanitation.

Introduction: Fundamentals of epidemiology, infectious and non-infectious
diseases, infectious disease transmission routes, organic and inorganic
contaminants, and health and water quality.

Human excreta and its characteristics, pollution caused by excreta, health
aspects of water supply and sanitation.

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Pathogens: Excreted bacteria, helminthes and their control, diseases transmitted by arthropod vectors (mosquito, flies, cockroaches, bugs, lice, etc).

Excreta treatment and disposal: Options, On site sanitation system (pit latrines, composting toilets and septic tank), Off site sanitation (septage collection, lagoon, waste stabilization ponds, anaerobic digestion).

Engineering and infectious diseases: Water related, excreta related, refuse related, housing related, diseases; reuse of wastes, watershed reservoir sanitation; engineering control of infectious diseases.

5.2 Environmental impact assessment.

Introduction: Concept of environmental assessment, Initial environmental examination (IEE), Environmental impact assessment (EIA), role of EIA, types of environmental impacts, and EIA principles.