

प्रदेश लोक सेवा आयोग

गण्डकी प्रदेश

इन्जिनियरिङ्ग सेवा, सिभिल समूह, स्यानिटरी उपसमूह, अधिकृत नवौं तहका पदको खुला, अन्तरतह र आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

द्वितीय पत्र : - सेवा सम्बन्धी प्राविधिक विषय

पूर्णाङ्क:- १००

1. Concepts and principles

1.1 Drinking Water

- Present status of Water Supply and Sanitation in Nepal
- Water supply projects,, planning and feasibility studies including multipurpose projects
- Participatory approach in water supply projects
- Present status of Water Supply and Sanitation in Gandaki province
- Major water supply projects in Gandaki province
- 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 characteristics, 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.

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2. Design, Treatment and Management

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.
- Design considerations for lifting water supply projects
- Groundwater for drinking water supply
- Climate change impacts on demand and supply sides of water supply project

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, sewer design criteria.
- Design of sanitary and storm water sewers and combined sewer systems.
- Sewer Appurtenances: Manholes, Inverted siphons, House connections, Storm water inlets, 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, 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.

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- 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
- Financial aspects: Tariff structure, tariff rates and affordability, System cost recovery
- Education and training

2.3.3 Industrial Wastewater system and treatment facility

- Sludge treatment, handling and disposal
- Operation and Maintenance
- Legal and Management aspects
- Financial aspects
- Education and training

2.3.4 Construction and Contract management

- Methods and construction technologies
- Contract management and quality aspects of construction
- Quality assurance plan and quality control

2.3.5 Participatory approach

- Participatory approach in the construction of drinking water supply and municipal wastewater system
- Water supply project operation and maintenance
- Asset management in water supply projects

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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 tubewell 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 pipings
- 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.
- 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).

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

6 Environmental Assessment.

- 6.1 Concept of environmental assessment, Brief environmental study (BES), Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA), role of EIA, EIA principles, types and impacts
- 6.2 Screening, Scoping, Initial Impact Identification, TOR preparation, EIA Report Writing
- 6.3 Management of BES/IEE/EIA process: Public Participation, EIA review, mitigation measures, Monitoring and Environmental Management Plan
- 6.4 Environmental Auditing
- 6.5 Relationship between infrastructure development, environment and climate change
- 6.6 Environmental and social Impact assessment in road sector and its mitigation.