

लोक सेवा आयोग
नेपाल इन्जिनियरिङ्ग सेवा, सिभिल समूह, स्यानिटरी उपसमूहको राजपत्राङ्कित तृतीय श्रेणी पदको खुला र
आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम
द्वितीय पत्र :- स्यानिटरी सम्बन्धी विषय

Section A- 20 Marks

1. Water supply

1.1 Introduction

- 1.1.1 Objectives of water supply
- 1.1.2 Potable, contaminated and wholesome water (definition)
- 1.1.3 Typical components of water supply schemes
- 1.1.4 Components of water supply engineering

1.2 Sources of water

- 1.2.1 Rainwater
- 1.2.2 Surface source: lake, streams/streams and impounded reservoirs
- 1.2.3 Underground sources: springs, wells/boreholes and infiltration galleries
- 1.2.4 Ground water occurrences and prospecting, chemical characteristics and properties of ground water, recharge of ground water, ground water recovery, tube well design
- 1.2.5 Selection of water sources

1.3 General Hydrology

- 1.3.1 Water resources and ecosystem, Hydrological cycle, fresh water
- 1.3.2 Water balance; precipitation; stream flow; evapo-transpiration
- 1.3.3 Aquifers: types of aquifers
- 1.3.4 Run-off

1.4 Quantity of water

- 1.4.1 Types of water demand
- 1.4.2 Design period
- 1.4.3 Methods of population forecasting
- 1.4.4 Variation in demand of water
- 1.4.5 Factors affecting demand of water

1.5 Quality of water

- 1.5.1 Water pollution: Types and sources of water pollution, effects of pollution (river, lake and reservoir), pollution of ground water
- 1.5.2 Hardness of water, types of hardness, alkalinity in water
- 1.5.3 Living organism in water: virus, algae, worms and bacteria
- 1.5.4 Water borne diseases: water borne, water washed, water-based and water-vector
- 1.5.5 Physical, chemical and biological test of water: test for temperature, colour odor, turbidity, pH, solids
- 1.5.6 Introductory bacteriological tests:- membrane filter, multiple tubes
- 1.5.7 Water quality standard: WHO standard of drinking water quality, Nepal interim standard of drinking water, guidelines for domestic use, Nepal guidelines

Section B- 20 Marks

1.6 Intake works

- 1.6.1 Site selection of an intake
- 1.6.2 Characteristics of river reservoir and spring intake
- 1.6.3 Various types of hand pumps including suction hand pump, submersible hand pumps (Tara, India Mark II and III etc)

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1.7 Water treatment:

- 1.7.1 Objectives of water treatment
- 1.7.2 Treatment systems: screening, plain sedimentation, sedimentation with coagulation, flocculation, filtration (Slow sand filtration /Rapid filtration), disinfection, softening, and miscellaneous treatments (aeration, removal of iron and manganese, removal of arsenic and removal of colour, odour and taste)
- 1.7.3 Sludge management, handling and disposal

1.8 Reservoirs and distribution systems

- 1.8.1 Types of reservoirs: types (Clear water reservoir, service reservoir, balancing reservoir, impounding reservoirs etc.), sizing of reservoirs: mass curve method, peak demand method etc. for reservoir design
- 1.8.2 Water supply system: pumping system, gravity system
- 1.8.3 Layout of the water supply system
- 1.8.4 Pipeline design: design criteria, design of transmission and distribution system (including pipe net works)

1.9 Conveyance of water

- 1.9.1 Pipe material types: Galvanized Iron (GI), Steel, Concrete, Ductile Iron (DI), cast iron (CI), PVC and High Density polyethylene (HDPE)
- 1.9.2 Laying of pipes
- 1.9.3 Pipe joints and their types

1.10 Valves and fittings

- 1.10.1 Valve types: sluice valve, reflux valve, safety valve, air valve and drain valve
- 1.10.2 Fittings: stop cocks, water taps, bends, tees, reducers, break pressure tanks, interruption chamber, valve box and etc
- 1.10.3 Public stand post
- 1.10.4 Maintenance of water supply system

1.11 Operation and maintenance of water supply system

- 1.11.1 Definition of operation and maintenance
- 1.11.2 Difference between maintenance and rehabilitation
- 1.11.3 Operation of water supply system
- 1.11.4 Maintenance equipments: wrench (pipe wrench, chain wrench, slide wrench, etc.)

Section C - 30 Marks

2 Sanitary Engineering

2.1 Introduction

- 2.1.1 Importance of waste water and solid waste management
- 2.1.2 Meaning and objectives of sewage disposal
- 2.1.3 Sanitation system: conservancy system and water carriage system
- 2.1.4 Types of sewerage systems: combined, separate and partially separate system

2.2 Quantity of wastewater

- 2.2.1 Sources and nature of wastewater, effluent characteristics
- 2.2.2 Factors affecting sanitary sewage
- 2.2.3 Determination of quantity of sanitary sewage
- 2.2.4 Determination of quantity of storm water, tangent method, limitation of rational method

2.3 Characteristics and examination of sewage

- 2.3.1 Sampling of sewage
- 2.3.2 Physical, chemical and biological characteristics of sewage
- 2.3.3 Decomposition of sewage, aerobic and anaerobic decomposition
- 2.3.4 Biochemical oxidation demand (BOD) and chemical oxidation demand (COD)
- 2.3.5 Test of solids, Dissolved oxygen (DO), pH-value, BOD, COD, chlorine demand

2.4 Design and construction of sewers

- 2.4.1 Typical design periods, flow velocity, self cleaning velocity, flow diagrams, hydraulic formulae and gradients
- 2.4.2 Estimation of quantity of sanitary sewage, collection systems, sewer design criteria.
- 2.4.3 Shape of sewers, types of sewers
- 2.4.4 Sewer materials: requirements, salt glazed stoneware, and plain or reinforced cement concrete pipes, plastic, steel, brick
- 2.4.5 Design of sanitary and storm water sewers for separate and combined sewer systems.
- 2.4.6 Construction of sewer: excavation, laying, jointing of sewer, testing of sewer, water test and air test

2.5 Sewer appurtenances

- 2.5.1 Manholes, drop-manholes and lamp holes
- 2.5.2 Catch basins
- 2.5.3 Flushing devices
- 2.5.4 Sand, grease and oil traps
- 2.5.5 Inverted siphons
- 2.5.6 Sewer outlets
- 2.5.7 Ventilating shaft
- 2.5.8 House connections
- 2.5.9 Storm water inlets

2.6 Sewage treatment

- 2.6.1 Objectives of treatment, treatment methods: physical, chemical and biological
- 2.6.2 Preliminary treatment processes: racks or screens, skimming tanks, grit chambers, sedimentation, and chemical precipitation
- 2.6.3 Secondary treatment processes and their types, BOD removal, design criteria, activated sludge, oxidation ponds and ditches, aerated lagoons and lagoons
- 2.6.4 Sewage filtration, intermittent sand filter, contact bed, trickling filters, bio- filters and design of trickling and bio-filters

2.7 Sewage disposal

- 2.7.1 Sewage disposal by dilution: essential conditions for dilution, self purification of streams, factors affecting self –purification, the oxygen sag curve (Streeter-Phelps equation)
- 2.7.2 Sewage treatment by land treatment: process, suitability of land treatment, methods of land treatment (irrigation, overland flow and rapid filtration)

2.8 Sludge treatment and disposal

- 2.8.1 Sources of sludge and necessity of treatment
- 2.8.2 Aerobic and anaerobic digestion

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- 2.8.3 Methods of sludge treatment: grinding and blending, thickening, stabilization, dewatering, drying, composting and incineration
2.8.4 Methods of sludge disposal: spreading on land, lagooning, dumping and land filling

Section D- 30 Marks

1.12 Community participation and introduce following under this heading

- 1.12.1 Users committee
1.12.2 Village maintenance workers
1.12.3 Pre construction/during construction/post construction trainings
1.12.4 Women participation
1.12.5 Community mobilization/participation
1.12.6 Record keeping of WSP
1.12.7 Rehabilitation

2.9 Onsite sanitation

- 2.9.1 Privies: pit privy, ventilated improved pit latrine, and pour-flush latrine
2.9.2 Septic tank: design construction, working and maintenance
2.9.3 Disposal of septic tank effluent: drain field, soak pits, washing and evapo- transpiration mounds
2.9.4 Composting toilets, eco-sanitation

3. Environment

- 3.1 General introduction of air pollutants, its causes, impacts and remedial measures
3.2 Human excreta and its characteristics, pollution caused by excreta, health aspects of water supply and sanitation
3.3 Green house effects, its impacts and remedial measures
3.4 Solid waste management
3.4.1 Types and characteristics of solid waste
3.4.2 Garbage collection and disposal
3.4.3 Methods of solid waste disposal: dumping, sanitary landfill, incineration and composting
3.5 Concept of environmental assessment
3.5.1 Initial environmental examination (IEE),
3.5.2 Environment impact assessment (EIA), role of EIA,
3.5.3 Types of environmental impacts, and EIA principles,
3.5.4 Government rules and regulations and procedures for EIA

द्वितीय पत्रको एकाईहरूको प्रश्नसंख्या निम्नानुसार हुनेछ

द्वितीयपत्रका खण्ड	A	B	C	D		
द्वितीयपत्रका एकाई	1.1, 1.2, 1.3, 1.4, 1.5	1.6, 1.7, 1.8, 1.9, 1.10, 1.11	2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8	1.12	2.9	3 (3.1 to 3.5)
प्रश्न संख्या	2	2	3	3		

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विषयगत नमूना प्रश्नहरु (Sample questions)

1. What are the factors for the selection of reservoir site?
2. With respect to water pollution, describe the effects and remedial measures for:
 - a) Arsenic
 - b) Iron
 - c) Suspended Solids
 - d) Calcium
3. Explain mass inflow (mass balance) curve method to determine balancing storage tank in a water supply system. Also describe demand curve.
4. Explain with sketch in detail slow sand filtration to treat water supply.
5. Write notes on the following:
 - a) Break point chlorination
 - b) Coagulation and Flocculation
 - c) Spring Intake
 - d) Residual Chlorine
6. What do you understand by the term Bio-Chemical Oxygen Demand (BOD) ? Describe its significance with respect to Waste Water Treatment system.
7. Describe Ventilated Improved Pit latrine and Pour-flush latrine to dispose excreta in isolated buildings.
8. Explain in detail the dilution method of disposal of sewage. State the Oxygen sag curve and write the factors affecting self-purification.
9. Write notes on the following:
 - a) Determination of storm water
 - b) Drop-manholes and lamp holes
 - c) Catch basins
 - d) Ventilating shaft
 - e) Sewer Materials
10. Explain the causes, effects and remedial measures of global warming. Also describe green house gases.

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नेपाल आर्थिक योजना तथा तथ्याङ्क, इन्जिनियरिङ्ग, कृषि, वन, विविध र शिक्षा सेवाका सबै समूह/उपसमूह,
राजपत्राङ्कित तृतीय श्रेणी र एवं स्वास्थ्य सेवाको सातौं र आठौं तहका पदहरूमा
प्रथम चरणको लिखित परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र
लिइने **सामूहिक परीक्षण (Group Test)** को लागि

सामूहिक छलफल (Group Discussion)

यस प्रयोजनको लागि गरिने परीक्षण १० पूर्णाङ्क र ३० मिनेट अवधिको हुनेछ जुन नेताविहिन सामूहिक छलफल (Leaderless Group Discussion) को रूपमा अवलम्बन गरिने छ। दिइएको प्रश्न वा Topic का विषयमा पालैपालोसँग निर्दिष्ट समयभित्र समूहबीच छलफल गर्दै प्रत्येक उम्मेदवारले व्यक्तिगत प्रस्तुति (Individual Presentation) गर्नु पर्नेछ। यस परीक्षणमा मूल्याङ्कनको लागि देहाय अनुसारको ३ जना भन्दा बढीको समिति रहनेछ।

आयोगका सदस्य	-	अध्यक्ष
आयोगका सदस्य	-	सदस्य
मनोविज्ञ	-	सदस्य
दक्ष/विज्ञ (१ जना)	-	सदस्य

सामूहिक छलफलमा दिइने नमूना प्रश्न वा Topic

उदाहरणको लागि - उर्जा संकट, गरीबी निवारण, स्वास्थ्य बीमा, खाद्य सुरक्षा, प्रतिभा पलायन जस्ता Topics मध्ये कुनै एक Topic मात्र दिइनेछ।