

काठमाण्डौ महानगरपालिका
नेपाल इन्जिनियरिङ्ग सेवा, स्यानिटरी समूह, अधिकृत छैटौं तह, स्यानिटरी इन्जिनियर पदको खूला र
आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम
एवं परीक्षा प्रणाली (योजना)

पाठ्यक्रमको रूपरेखा :- यस पाठ्यक्रमको आधारमा निम्नानुसार दुई चरणमा परीक्षा लिइने छ :

प्रथम चरण :- लिखित परीक्षा पूर्णाङ्क :- २००
द्वितीय चरण :- अन्तर्वार्ता पूर्णाङ्क :- ३०

१. प्रथम चरण: - लिखित परीक्षा योजना (Written Examination Scheme)

पत्र	विषय	पूर्णाङ्क	उतीर्णाङ्क	परीक्षा प्रणाली	प्रश्नसंख्या X अङ्क	समय
प्रथम	सिभिल इन्जिनियरिङ्ग सम्बन्धी विषय	१००	४०	वस्तुगत: बहुवैकल्पिक प्रश्न (MCQ)	१०० प्रश्न x १ अङ्क	१ घण्टा १५ मिनेट
द्वितीय	स्यानिटरी सम्बन्धी विषय	१००	४०	विषयगत	१० प्रश्न x १० अङ्क	३ घण्टा

२. द्वितीय चरण: - अन्तर्वार्ता (Interview)

विषय	पूर्णाङ्क	परीक्षा प्रणाली
अन्तर्वार्ता (Interview)	३०	मौखिक (Oral)

द्रष्टव्य :

- यो पाठ्यक्रम रूपरेखालाई प्रथम चरण (लिखित परीक्षा) र द्वितीय चरण (अन्तर्वार्ता) गरी दुई चरणमा विभाजन गरिएको छ ।
- लिखित परीक्षाको माध्यम भाषा अंग्रेजी वा नेपाली अथवा अंग्रेजी र नेपाली दुवै हुन सक्नेछ ।
- प्रथम र द्वितीय पत्रको विषयवस्तु फरक फरक हुनेछ, तथा प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।
- प्रथम पत्रका एकाईहरूको प्रश्नसंख्या यथासम्भव निम्नानुसार हुनेछ । द्वितीय पत्रको पाठ्यक्रमका एकाईहरूबाट सोधिने प्रश्नहरूको संख्या द्वितीयपत्रको पाठ्यक्रम उल्लेख भए अनुसार हुनेछ ।

प्रथम पत्रका एकाई	1	2	3	4	5	6	7	8	9
प्रश्न संख्या	20	15	12	12	10	10	8	8	5

- वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नहरूको गलत उत्तर दिएमा प्रत्येक गलत उत्तर बापत २० प्रतिशत अङ्क कट्टा गरिनेछ । तर उत्तर नदिएमा त्यस बापत अङ्क दिइने छैन र अङ्क कट्टा पनि गरिने छैन ।
- बहुवैकल्पिक प्रश्नहरू हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।
- विषयगत प्रश्नका लागि तोकिएका १० अङ्कका प्रश्नहरूको हकमा १० अङ्कको एउटा लामो प्रश्न वा एउटै प्रश्नका दुई वा दुई भन्दा बढी भाग (Two or more parts of a single question) वा एउटा प्रश्न अन्तर्गत दुई वा बढी टिप्पणीहरू (Short notes) सोध्न सकिने छ ।
- यस पाठ्यक्रम योजना अन्तर्गतका पत्र/विषयका विषयवस्तुमा जेसुकै लेखिएको भए तापनि पाठ्यक्रममा परेका कानून, ऐन, नियम तथा नीतिहरू परीक्षाको मिति भन्दा ३ महिना अगाडि (संशोधन भएका वा संशोधन भई हटाईएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्यक्रममा परेको सम्झनु पर्दछ ।
- प्रथम चरणको परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ ।

१०. पाठ्यक्रम लागू मिति :-

काठमाण्डौ महानगरपालिका
नेपाल इन्जिनियरिङ्ग सेवा, स्यानिटरी समूह, अधिकृत छैटौं तह, स्यानिटरी इन्जिनियर पदको खूला र
आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

काठमाडौं महानगरपालिका
नेपाल इन्जिनियरिङ्ग सेवा, स्यानिटरी समूह, खुला र आन्तरिक प्रतियोगितात्मकको
छैटौं तह (अधिकृत वा सो सरह) को
लिखित परीक्षाको पा
ठ्यक्रमको ढाँचा

प्रथम पत्र :- सिभिल इन्जिनियरिङ्ग सम्बन्धी विषय

- 1. Structure Analysis and Design** **20%**
 - 1.1 Stresses and strains; theory of torsion and flexure; moment of inertia
 - 1.2 Analysis of beams and frames: Bending moment, shear force and deflection of beams and frames: determinate structure - Energy methods; three hinged systems, indeterminate structures- slope deflection method and moment distribution method; use of influence line diagrams for simple beams, unit load method
 - 1.3 Reinforced concrete structures: Difference between working stress and limit state philosophy, analysis of RC beams and slabs in bending, shear, deflection, bond and end anchorage, Design of axially loaded columns; isolated and combined footings, introduction to pre-stressed concrete
 - 1.4 Steel and timber structures: Standard and built-up sections: Design of riveted, bolted and welded connections, design of simple elements such as ties, struts, axially loaded and eccentric columns, column bases, Design principles on timber beams and columns

- 2. Construction Materials** **15%**
 - 2.1 Properties of building materials: physical, chemical, constituents, thermal etc.
 - 2.2 Stones-characteristics and requirements of stones as a building materials
 - 2.3 Ceramic materials: ceramic tiles, Mosaic Tile, brick types and testing etc.
 - 2.4 Cementing materials: types and properties of lime and cement; cement mortar tests
 - 2.5 Metals: Steel; types and properties; Alloys
 - 2.6 Timber and wood: timber trees in Nepal, types and properties of wood
 - 2.7 Miscellaneous materials: Asphaltic materials (Asphalt, Bitumen and Tar); paints and varnishes; polymers
 - 2.8 Soil properties and its parameters

- 3. Concrete Technology** **12%**
 - 3.1 Constituents and properties of concrete (physical and chemical)
 - 3.2 Water cement ratio
 - 3.3 Grade and strength of concrete, concrete mix design, testing of concrete
 - 3.4 Mixing, transportation pouring and curing of concrete
 - 3.5 Admixtures

काठमाण्डौ महानगरपालिका
नेपाल इन्जिनियरिङ्ग सेवा, स्यानिटरी समूह, अधिकृत छैटौं तह, स्यानिटरी इन्जिनियर पदको खुला र
आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

- 3.6 High strength concrete
- 3.7 Pre-stressed concrete technology
- 4. Construction Management 12%**
- 4.1 Construction scheduling and planning: network techniques (CPM, PERT) and bar charts
- 4.2 Contractual procedure and management: types of contract, tender and tender notice, preparation of bidding (tender) document, contractors pre-qualification, evaluation of tenders and selection of contractor, contract acceptance, condition of contract; quotation and direct order, classifications of contractors; dispute resolution; muster roll
- 4.3 Material management: procurement procedures and materials handling
- 4.4 Cost control and quality control
- 4.5 Project maintenance
- 4.6 Occupational health and safety
- 4.7 Project monitoring and evaluation
- 4.8 Quality assurance plan
- 4.9 Variation, alteration and omissions
- 5. Estimating and Costing Valuation and Specification 10%**
- 5.1 Types of estimates and their specific uses
- 5.2 Methods of calculating quantities
- 5.3 Key components of estimating norms and rate analysis
- 5.4 Preparation of bill of quantities
- 5.5 Purpose, types and importance of specification
- 5.6 Purpose, principles and methods of valuation
- 6. Drawing Techniques 10%**
- 6.1 Drawing sheet composition and its essential components
- 6.2 Suitable scales, site plans, preliminary drawings, working drawings etc
- 6.3 Theory of projection drawing: perspective, orthographic and axonometric projection; first and third angle projection
- 6.4 Drafting tools and equipments
- 6.5 Drafting conventions and symbols
- 6.6 Topographic, electrical, plumbing and structural drawings
- 6.7 Techniques of free hand drawing
- 7. Engineering Survey 8%**
- 7.1 Introduction and basic principles
- 7.2 Linear measurements: techniques; chain, tape, ranging rods and arrows; representation of measurement and common scales; sources of errors; effect of slope and slope correction; correction for chain and tape measurements; Abney level and clinometers
- 7.3 Compass and plane table surveying: bearings; types of compass; problems and sources of errors of compass survey; principles and methods of plane tabling

काठमाण्डौ महानगरपालिका

नेपाल इञ्जिनियरिङ्ग सेवा, स्यानिटरी समूह, अधिकृत छैटौं तह, स्यानिटरी इञ्जिनियर पदको खूला र आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

- 7.4 Leveling and contouring: Principle of leveling; temporary and permanent adjustment of level; bench marks; booking methods and their reductions; longitudinal and cross sectioning; reciprocal leveling; trigonometric leveling; contour interval and characteristics of contours; methods of contouring
 - 7.5 Theodolite traversing: need of traverse and its significance; computation of coordinates; adjustment of closed traverse; closing errors
 - 7.6 Uses of Total Station and Electronic Distance Measuring Instruments
- 8. Engineering Economics 8%**
- 8.1 Benefit cost analysis, cost classification, sensitivity analysis, internal rate of return, time value of money; economic equilibrium, demand, supply and production, net present value, financial and economic evaluation
- 9. Professional Practices 5%**
- 9.1 Ethics and professionalism: code of conduct and guidelines for professional engineering practices
 - 9.2 Nepal Engineering Council Act, 2055 and regulations, 2056
 - 9.3 Relation with clients, contractor and fellow professionals
 - 9.4 Public procurement practices for works, goods and services and its importance

काठमाण्डौ महानगरपालिका
नेपाल इन्जिनियरिङ्ग सेवा, स्यानिटरी समूह, अधिकृत छैटौं तह, स्यानिटरी इन्जिनियर पदको खूला र
आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

काठमाण्डौ महानगरपालिका
नेपाल इन्जिनियरिङ्ग सेवा, स्यानिटरी समूह, खुला र आन्तरिक प्रतियोगितात्मकको
छैटौं तह (अधिकृत वा सो सरह) को
लिखित परीक्षाको पाठ्यक्रमको ढाँचा

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/rivers 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 ather-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

काठमाण्डौ महानगरपालिका
नेपाल इन्जिनियरिङ्ग सेवा, स्यानिटरी समूह, अधिकृत छैटौं तह, स्यानिटरी इन्जिनियर पदको खूला र
आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

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)

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

काठमाण्डौ महानगरपालिका
नेपाल इन्जिनियरिङ्ग सेवा, स्यानिटरी समूह, अधिकृत छैटौं तह, स्यानिटरी इन्जिनियर पदको खूला र
आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

- 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
 - 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
- 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

Section D- 30 Marks

- 1.12 Community Participation in Water Supply and Sanitation Schemes
 - 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

3. Environment

- 3.1 General introduction of air pollutants, its causes, impacts and remedial measures

काठमाण्डौ महानगरपालिका
नेपाल इन्जिनियरिङ्ग सेवा, स्यानिटरी समूह, अधिकृत छैटौं तह, स्यानिटरी इन्जिनियर पदको खुला र
आन्तरिक प्रतियोगितात्मक लिखित परीक्षाको पाठ्यक्रम

- 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
 - 3.4.4 Management of land fill site and its implications
- 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