

काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन बोर्ड
प्राविधिक सेवा, इञ्जिनियरिङ समूह, गुणस्तर उपसमूह, ७ तह, केमिष्ट पदको खुला प्रतियोगितात्मक परीक्षाको
पाठ्यक्रम

पाठ्यक्रमको रूपरेखा :- यस पाठ्यक्रमको आधारमा निम्नानुसारका चरणमा परीक्षा लिइने छ :

प्रथम चरण :- लिखित परीक्षा

पूर्णाङ्क :- १००

द्वितीय चरण :- अन्तर्वार्ता

पूर्णाङ्क :- ५०

परीक्षा योजना (Examination Scheme)

१. प्रथम चरण : लिखित परीक्षा (Written Examination)

पूर्णाङ्क :- १००

पत्र	विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली	प्रश्नसंख्या X अङ्क	समय
प्रथम	सेवा समूह सम्बन्धी	१००	४०	वस्तुगत बहुवैकल्पिक (Multiple Choice)	५० प्रश्न X १ अङ्क	३ घण्टा
				विषयगत (Subjective)	१० प्रश्न X ५ अङ्क	

२. द्वितीय चरण : अन्तर्वार्ता (Interview)

पूर्णाङ्क :- ५०

विषय	पूर्णाङ्क	परीक्षा प्रणाली
व्यक्तिगत अन्तर्वार्ता	५०	मौखिक

द्रष्टव्य :

- लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी हुनेछ ।
- लिखित परीक्षामा यथासम्भव पाठ्यक्रमका सबै एकाईबाट प्रश्नहरु सोधिनेछ ।
- वस्तुगत बहुवैकल्पिक (Multiple Choice) प्रश्नहरुको 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 ।
- विषयगत प्रश्नमा प्रत्येक पत्र/विषयका प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरु हुनेछन् । परीक्षार्थीले प्रत्येक खण्डका प्रश्नहरुको उत्तर सोही खण्डका उत्तरपुस्तिकामा लेख्नुपर्नेछ ।
- यस पाठ्यक्रम योजना अन्तर्गतका पत्र/विषयका विषयवस्तुमा जेसुकै लेखिएको भए तापनि पाठ्यक्रममा परेका कानून, ऐन, नियम तथा नीतिहरु परीक्षाको मिति भन्दा ३ महिना अगाडि (संशोधन भएका वा संशोधन भई हटाईएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्यक्रममा परेको सम्भन्नु पर्दछ ।
- प्रथम चरणको परीक्षाबाट छनौट भएका उम्मेदवारहरुलाई मात्र द्वितीय चरणको परीक्षामा सम्मिलित गराइनेछ ।
- पाठ्यक्रम लागू मिति :-

1. Physical Chemistry

- 1.1 **Ionic Equilibrium and Electrochemistry:** pH, Buffer solution, buffer capacity and buffer range, pH change in acid base titration, theory of acid base indicator, hydrolysis of salt, Debye Huckel limiting law, activity and activity coefficient, Ionic strength, Elementary idea on electrical double layer, Emf of a cell, Nernst equation, glass electrode, ion selective electrode and their applications, photo electrochemical and fuel cells
- 1.2 **Chemical Kinetics:** Effect of temperature and catalyst on reaction rate, concept of activation energy, collision theory and transition state theory of reaction rates, chain reaction, photochemical reaction, Fast reaction, techniques to study fast reaction, Enzyme catalyzed reaction, Diffusion controlled reaction in solution kinetic salt effect
- 1.3 **Thermodynamics:** Statistical treatment of entropy, Entropy change in physical and chemical change, free energy change for reaction, Gibbs Helmholtz equation, Thermodynamic criteria of equilibrium, chemical potential, partial molar quantities, Boltzman distribution law
- 1.4 **Spectroscopy:** Electromagnetic radiation, origin of molecular spectra, types of molecular spectra: Rotational spectra, vibrational spectra, vibrational rotational spectra, Electronic spectra
- 1.5 **Solid State Chemistry:** Seven crystal system and fourteen Bravais lattice, Bragg's law, Crystal structure of sodium chloride, Lattice energy of ionic solid, success and limitation of classical free electron theory of metal, point defects: Frenkel and Schottky defects

2. Inorganic chemistry

- 2.1 General concept of the followings: Electro-negativity, choice of electro-negativity system, group electronegativity, electron affinity, anomalous electron affinity, ionization energy, Intrinsic and mean bond energy. Metallic bonding, Buckminsterfullerene, Noble gas compounds, Non aqueous solvents, Protic and non-protic solvents, Reactions of NH_3 and SO_2
- 2.2 Molecular orbital theory, molecular orbital, LCAO approximation, valence bond theory for simple homonuclear diatomic molecules/ions
- 2.3 Bonding and applications of coordinate compounds: Valence bond theory, crystal field, characterization of coordinate compounds, Isomerism in coordination compounds, ligand substitution reactions and trans effect, spectrochemical series, Nepelausetic effect, Jahn Teller effect, Evidence for adjusted crystal field theory
- 2.4 Organometallic compounds: General survey of types, synthetic methods, metallocenes
- 2.5 Radioactivity and nuclear reactions, ^{14}C dating, tracer technique, radiochemical analysis

3. Analytical chemistry

- 3.1 General concept of statistical methods in chemical analysis: Accuracy, precision, minimization of error, significant figures, mean and standard deviation, reliability of results, rejection of results, regression analysis, t-test, chi-test
- 3.2 Principle and applications of: Atomic absorption spectroscopy, flame photometry, uv-vis spectrophotometry, NMR, IR, mass spectroscopy, emission spectroscopy
- 3.3 Principle and applications of potentiometry, ion selective electrodes, pH measurement, polarography, amperometry, electrogravimetry and conductometry
- 3.4 Gravimetric and volumetric analysis : Principles of volumetric and gravimetric analysis, uses of adsorption indicators, types of titration and use of suitable indicators, use of Redox indicator, metal ion indicator, use of common organic reagents in gravimetric analysis

4. Organic Chemistry

- 4.1 **General:** Tetra-covalency and catenation property of carbon, classification of organic compounds, functional groups and homologous series, empirical formula, molecular formula, structural formula and contracted formula, structural isomerism, stereoisomerism, detection of N,S and halogens by Lassagne's test
- 4.2 **Nomenclature:** Common names and IUPAC rules of naming of simple organic compounds
- 4.3 **Preliminary Idea of Reaction Mechanism:** Homolytic and heterolytic fission, electrophiles, nucleophiles, free-radicals, carbocations, carboanions, inductive effect, hyper-conjugation
- 4.4 **Hydrocarbons:** Aliphatic, aromatic, saturated and unsaturated hydrocarbons, quality of gasoline, octane number and gasoline additive, characteristics of aromatic compounds, Huckel's rule, structure of benzene, isomerism and orientation of benzene derivatives
- 4.5 **Properties and Uses:** Haloalkanes and chlorobenzene, alcohols and phenol, aldehydes and ketones, amines and aniline, nitrobenzene and nitroalkane
- 4.6 **Molecules of Life: Carbohydrates:** classification, structure of glucose and fructose, function of carbohydrates; **Protein:** amino acid and their functions, essential and non-essential amino-acids, peptide linkage; **Nucleic acid**, basic components of nucleic acid; difference between RNA and DNA; biological function of nucleic acid; **Lipids:** difference between fats and oils, function of lipid; **Enzymes:** enzymes and their functions
- 4.7 **Chemistry in Service to Mankind: Polymers:** natural and synthetic polymers, PVC, polyethene, polystyrene, Teflon, nylon-66, Bakelite; **Dyes:** definition, natural and synthetic dyes; **Fertilizers:** chemical and organic fertilizers, fertilizer as pollutants; **Drugs:** names and uses of some common drugs (brufen, morphine, phenacetin, aspirin, paracetamol, pencillin, chloramphenicol, sulphadiazine, lysergic acid); **Pesticides:** DDT, BHC malathion, parathion and their uses
- 4.8 **Introduction of Green Chemistry:** Basic principle and of green chemistry, green catalyst (phase transfer catalyst)

खण्ड (ख) – (५० अङ्क)

5. Laboratory Management and Applied Chemistry

- 5.1 General idea of safety precautions in the laboratory, care and maintenance of laboratory equipments
- 5.2 Application of good laboratory practice and ISO concepts in the quality management
- 5.3 Soil, sediments and rock analysis:
 - 5.3.1 Soil texture and organic matter in soil
 - 5.3.2 Cu, Pb, Zn & Ag in soil, sediments and rock
 - 5.3.3 Acid insoluble matter, loss on ignition, CaO, MgO, total oxide ((Fe₂O₃, Al₂O₃) and SiO₂ in limestone, dolomite and magnesite
- 5.4 Water, wastewater and air analysis:
 - 5.4.1 BOD, COD, dissolved oxygen, alkalinity, ammonia, nitrite, nitrate, chloride, phosphate, sulfate, iron, manganese, arsenic and other toxic metals in water and wastewater.
 - 5.4.2 PM₁₀, TSS, SO₂, CO, CO₂, NO_x in air
- 5.5 Food, food products and feed analysis:
 - 5.5.1 Proximate analysis (moisture, protein, fat and carbohydrate) of food, food products and feed
 - 5.5.2 Color detection in food and food products
 - 5.5.3 Simple chemical methods (quick test) for detection of food adulteration
 - 5.5.4 General concept of Pesticide and pesticide residue analysis in water, soil and foodstuff
- 5.6 Role of Chemists in Environmental Impact Assessment

6. Microbiology

- 6.1 Introduction, Classification, Structure, Physiology and Identification of Common water borne pathogens; Water-borne diseases, prevention and their control
- 6.2 Water Microbiology
 - 6.2.1 Overview on sources of surface and ground water and its characters
 - 6.2.2 Growth and survival of microorganisms in fresh water environments
 - 6.2.3 Effects of Light, Hydrostatic pressure, Turbidity, pH and Inorganic and Organic constituents on aquatic microorganisms
- 6.3 Water Pollution
 - 6.3.1 Sources of pollution of river and water bodies and consequences
 - 6.3.2 Types of pollutants
 - 6.3.3 Analytical and removal methods
- 6.4 Water Treatments
 - 6.4.1 Principle and procedures of small scale water purification system
 - 6.4.2 Principle, Procedures Technologies of treatment of Urban Water Supply System: Sedimentations, Coagulation/Flocculation, Filtration and Disinfection process and different chemicals used in these processes

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6.5 Drinking Water Quality Control

- 6.5.1 Quality control and quality assurances systems and HACCP concept
- 6.5.2 Drinking water related regulators agencies in Nepal
- 6.5.3 National and international conventional water quality standards, WHO (Drinking Water Quality Guidelines), National Drinking Water Quality Standard (NDWQS)

6.6 Water Quality Analysis : Principle and Procedures of Microbiological and Physiochemical Analysis of Water

- 6.6.1 Microbiological Parameters
- 6.6.2 Physiochemical Parameters
- 6.6.3 Inorganic parameters including heavy metals
- 6.6.4 Organic Compounds and Pesticides

6.7 Instrumentation

- 6.7.1 Working principle, instrumentation and application of phase contract and electron Microscopes
- 6.7.2 Principles types and uses of: Centrifugation technique, Electrophoresis techniques. Chromatography technique (Paper chromatography, Thin layer chromatography, Gas liquid chromatography, High Performance Liquid Chromatography (HPLC))

7. खानेपानी व्यवस्थापन तथा सरसफाई सम्बन्धी

- 7.1 काठमाण्डौ उपत्यकामा खानेपानीको वर्तमान अवस्था, संभावना र चुनौतीहरु
- 7.2 काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन बोर्डको परिचय, काम, कर्तव्य र अधिकार
- 7.3 नेपालमा खानेपानी व्यवस्थापनको भावी रणनीति र कार्यादिशा
- 7.4 काठमाण्डौ उपत्यकामा उपलब्ध पानीको गुणस्तर र सुद्धिकरणका तरिकाहरु
- 7.5 काठमाण्डौ उपत्यका खानेपानी व्यवस्थापन बोर्ड र काठमाण्डौ उपत्यका खानेपानी लिमिटेड वीचको अन्तरसम्बन्ध
- 7.6 खानेपानीको गुणस्तर सम्बन्धमा विद्यमान राष्ट्रिय अन्तरराष्ट्रिय मापदण्ड
- 7.7 मेलम्ची खानेपानी आयोजना संचालनको उद्देश्य, हालसम्मको प्रगति तथा आयोजनाले पार्ने सामाजिक प्रभाव
 - 7.7.1 मेलम्ची खानेपानी उप आयोजना १ (मेलम्ची खानेपानी विकास समिति)
 - 7.7.2 मेलम्ची खानेपानी उप आयोजना २ (आयोजना कार्यान्वयन निर्देशनालय - KUKL)
- 7.8 खानेपानी तथा सरसफाई क्षेत्रमा सार्वजनिक नीजि साझेदारी (PPP) को अवधारणा र जिम्मेवारी हस्तान्तरण
- 7.9 खानेपानी तथा सरसफाई सम्बन्धी दिगो विकास लक्ष्य (Sustainable Development Goals) र
- 7.10 काठमाण्डौ काठमाडौं उपत्यकामा फोहोरमैला व्यवस्थापन, सरसफाई र ढल निकासको वर्तमान अवस्था, सम्भाव्यता तथा चुनौतीहरु
- 7.11 काठमाण्डौ उपत्यकाको खानेपानी उत्पादन, प्रशोधन र वितरण प्रणाली सम्बन्धी जानकारी
- 7.12 वर्षातको पानी संकलन, पुनर्भरण तथा भूमिगत जल उपयोग सम्बन्धी कानूनी व्यवस्था
- 7.13 खानेपानी गुणस्तर नियन्त्रण सम्बन्धमा कानूनी व्यवस्था

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8. संबिधान, ऐन, नियम र नीति

- 8.1 नेपालको संविधान
- 8.2 खानेपानी व्यवस्थापन बोर्ड ऐन, २०६३
- 8.3 काठमाडौं उपत्यका खानेपानी व्यवस्थापन बोर्ड नियमावली, २०६४
- 8.4 काठमाण्डौं उपत्यका खानेपानी व्यवस्थापन बोर्ड कर्मचारी प्रशासन नियमावली
- 8.5 टैक्कर व्यवसाय संचालन सम्बन्धी अनुमतिपत्र जारी गर्ने निर्देशिका २०७३
- 8.6 काठमाण्डौं उपत्यका भूमिगत जलश्रोत व्यवस्थापन नीति, २०६९
- 8.7 भूमिगत श्रोतको पानी निकाल तथा उपयोग गर्न अनुमती पत्र जारी गर्ने निर्देशिका, २०७१
- 8.8 राष्ट्रिय खानेपानी गुणस्तर मापदण्ड, २०६२
- 8.9 खानेपानी महशुल निर्धारण आयोग ऐन, २०६३
- 8.10 उपभोक्ता संरक्षण ऐन, २०५४ र उपभोक्ता संरक्षण नियमावली, २०५५
- 8.11 वातावरण संरक्षण ऐन, २०५३ र वातावरण संरक्षण नियमावली २०५४
- 8.12 जलश्रोत ऐन, २०४९ र जलश्रोत नियमावली, २०५०
- 8.13 भ्रष्टाचार निवारण ऐन, २०५९
- 8.14 नेपाल गुणस्तर प्रमाण चिन्ह ऐन, २०३७ र नेपाल गुणस्तर प्रमाण चिन्ह नियमावली, २०४०

यस पत्रको लागि यथासम्भव निम्नानुसार प्रश्नहरु सोधिने छ ।

पत्र/विषय :- सेवा समूह सम्बन्धी				
विषय	खण्ड	अङ्गभार	वस्तुगत	विषयगत
सेवा सम्बन्धी	(क)	५०	२५ प्रश्न X १ अङ्ग = २५	५ प्रश्न X ५ अङ्ग = २५
	(ख)	५०	२५ प्रश्न X १ अङ्ग = २५	५ प्रश्न X ५ अङ्ग = २५
जम्मा		१००	५० प्रश्न X १ अङ्ग = ५०	१० प्रश्न X ५ अङ्ग = ५०