

लोक सेवा आयोग
नेपाल इन्जिनियरिङ्ग सेवा, केमिष्ट्री समूह, राजपत्रांकित तृतीय श्रेणीका पदको खुला प्रतियोगितात्मक परीक्षाको
पाठ्यक्रम

यस पाठ्यक्रम योजनालाई दुई चरणमा विभाजन गरिएको छ :

प्रथम चरण :-	लिखित परीक्षा (Written Examination)	पूर्णाङ्क :- २००
द्वितीय चरण :-	(क) सामूहिक परीक्षण (Group Test)	पूर्णाङ्क :- १०
	(ख) अन्तर्वार्ता (Interview)	पूर्णाङ्क :- ३०

परीक्षा योजना (Examination Scheme)

प्रथम चरण : लिखित परीक्षा(Written Examination)

पूर्णाङ्क :- २००

पत्र	विषय	खण्ड	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली		प्रश्नसंख्या × अङ्क	समय
प्रथम	General Subject	Part I: General Awareness & General Reasoning Test	१००	४०	वस्तुगत (Objective)	बहुवैकल्पिक प्रश्न (MCQs)	५० प्रश्न × १ अङ्क	१ घण्टा ३० मिनेट
		Part II: General Technical Subject					५० प्रश्न × १ अङ्क	
द्वितीय	Technical Subject		१००	४०	विषयगत (Subjective)	छोटो उत्तर लामो उत्तर	४ प्रश्न × ५ अङ्क ८ प्रश्न × १० अङ्क	३ घण्टा

द्वितीय चरण : सामूहिक परीक्षण (Group Test) र अन्तर्वार्ता (Interview)

पूर्णाङ्क :- ४०

पत्र / विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली	समय
सामूहिक परीक्षण (Group Test)	१०		सामूहिक छलफल (Group Discussion)	३० मिनेट
अन्तर्वार्ता (Interview)	३०		बोर्ड अन्तर्वार्ता(Board Interview)	-

द्रष्टव्य :

- लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुनेछ।
- प्रथमपत्र र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ।
- 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 प्रश्नहरूको हकमा तोकिएको अंको 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।
- द्वितीय पत्रमा (विषयगत प्रश्न हुनेका हकमा) प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन्। परिक्षार्थीले प्रत्येक खण्डका प्रश्नहरूको उत्तर सोहीखण्डको उत्तरपुस्तिकामा लेख्नुपर्नेछ।
- 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 सम्भन्नु पर्दछ।
- प्रथमचरणको परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र द्वितीयचरणको परीक्षामा सम्मिलित गराइनेछ।
- यस भन्दा अगाडि लागू भएका माथि उल्लेखित सेवा, समूहको पाठ्यक्रम खारेज गरिएको छ।
- पाठ्यक्रम लागू मिति : २०८०/०७/२०

प्रथम पत्र (Paper I): General Subject

Part (I) : - General Awareness & General Ability Test (50 Marks)

1. **General Awareness and Contemporary Issues** (25 ×1 Mark = 25 Marks)
 - 1.1 Physical, socio-cultural and economic geography and demography of Nepal
 - 1.2 Major natural resources of Nepal
 - 1.3 Geographical diversity, climatic conditions, and livelihood & lifestyle of people
 - 1.4 Notable events and personalities, social, cultural and economic conditions in modern history of Nepal
 - 1.5 Current periodical plan of Nepal
 - 1.6 Information on sustainable development, environment, pollution, climate change, biodiversity, science and technology
 - 1.7 Nepal's international affairs and general information on the UNO, SAARC & BIMSTEC
 - 1.8 The Constitution of Nepal (From Part 1 to 5 and Schedules)
 - 1.9 Governance system and Government (Federal, Provincial and Local)
 - 1.10 Provisions of civil service act and regulation relating to constitution of civil service, organisational structure, posts of service, fulfillment of vacancy and code of conduct
 - 1.11 Functional scope of public services
 - 1.12 Public Service Charter
 - 1.13 Concept, objective and importance of public policy
 - 1.14 Fundamentals of management : planning, organizing, directing, controlling, coordinating, decision making, motivation and leadership
 - 1.15 Government planning, budgeting and accounting system
 - 1.16 Major events and current affairs of national and international importance
2. **General Reasoning Test** (25 ×1 Mark = 25 Marks)
 - 2.1 **Logical Reasoning** (9×1 Mark = 9 Marks)

Verbal Ability, Alphanumeric Series, Reasoning Analogies, Classification, Coding-Decoding, Order & Ranking, Distance & Directions, Analytical and Logical Reasoning, Assertion and Reason, Statement and Conclusion, Input-Output, Venn- diagram
 - 2.2 **Numerical Reasoning** (8×1 Mark = 8 Marks)

Arithmetic Series, Analogy, Classification, Arithmetical Reasoning, Fraction, Percentage, Ratio, Average, Profit & Loss, Time & Work, Date & Calender, Data Sufficiency, Data Interpretation & Data Verification
 - 2.3 **Spatial Reasoning** (8×1 Mark = 8 Marks)

Figure Series, Figure Analogy, Figure Classification, Figure Matrix, Pattern Completion, Embedded Images, Image Formation & Analysis, Mirror and Water Images, Cubes and Dices, Paper Folding & Cutting

Part (B) : - General Technical Subject (50 Marks)

Section A- 20 % Marks

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 and Solid state chemistry: Electromagnetic radiation, origin of molecular spectra, types of molecular spectra: Rotational spectra, vibrational spectra, vibrational rotational spectra, Electronic spectra. 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

Section B- 30 %Marks

2. Inorganic chemistry

10%

- 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, Buck minister fullerene, 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
- 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, Nephelausetic 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

20%

- 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 Solvent extraction, ion exchange chromatography, gas chromatography, HPLC, exclusion chromatography (gel permeation chromatography), affinity; chromatography, partition, column, and paper chromatography, thermo gravimetric analysis, differential thermal analysis,
- 3.4 Principle and applications of potentiometry, ion selective electrodes, pH measurement, polarography, amperometry, electrogravimetry and conductometry.
- 3.5 Gravimetric and volumetric analysis, principles of volumetric and gravimetric analysis, uses of adsorption indicators, use of Redox indicator, metal ion indicator, use of common organic reagents in gravimetric analysis.

Section C- 20 %Marks

4. Organic Chemistry

- 4.1 General idea on types, mechanism and scope of the followings:
 - 4.1.1 Nucleophilic reaction
 - 4.1.2 Elimination reaction
 - 4.1.3 Addition reaction
 - 4.1.4 Free radical reaction
- 4.2 Study and application of the followings:
 - 4.2.1 Oxidation and reduction reactions
 - 4.2.2 Halogenations
 - 4.2.3 Acetylation
 - 4.2.4 Alkylation
 - 4.2.5 Acylation
 - 4.2.6 Aldol condensation and related reactions.
- 4.3 Photochemistry:
 - 4.3.1 Basic concept of Photochemical energy
 - 4.3.2 Electronic excitation
 - 4.3.3 Energy transfer
 - 4.3.4 Photochemistry of carbonyl compounds
- 4.4 Heterocyclic Chemistry: Structure and reactivity of the following heterocyclic compounds:-
 - 4.4.1 Pyrrole
 - 4.4.2 Thiazole
 - 4.4.3 Furan
 - 4.4.4 Imidazole
 - 4.4.5 Pyridine
 - 4.4.6 Indole
- 4.5 Stereochemistry:
 - 4.5.1 Symmetry and symmetry elements
 - 4.5.2 Enantiomers
 - 4.5.3 Diastereomers
 - 4.5.4 Meso-isomers
 - 4.5.5 Racemic mixture
 - 4.5.6 Enantioselective reaction
 - 4.5.7 Diastereoselective reaction
 - 4.5.8 Regioselective reaction
- 4.6 Carbohydrate: Chemistry of Glucose, fructose, sucrose and cellulose

Section D- 30 % Marks

5. Biochemistry and applied chemistry

5.1 Biochemistry

10%

5.1.1 Natural products and drug analysis:

- 5.1.1.1 Phytochemical screening
- 5.1.1.2 Isolation, purification and identification of natural molecules (essential oil, alkaloids, terpenoids, flavonoids)
- 5.1.1.3 Biosynthesis of lipids and terpenes with taking typical examples of stearic acid and citral
- 5.1.1.4 Vitamins and hormone
- 5.1.1.5 Chemotherapy
- 5.1.1.6 Drugs
- 5.1.1.7 Synthetic drugs: types and typical examples
- 5.1.1.8 Identification, qualitative and quantitative analysis of various antibiotics
- 5.1.1.9 Quantitative analysis of dextrose, ascorbic acid, vitamin A in various products

5.1.2 Lipids:

- 5.1.2.1 Composition of fats
- 5.1.2.2 Hydrolyses
- 5.1.2.3 Phosphoglycerides
- 5.1.2.4 Rancidity types
- 5.2.1.5 Prevention

5.1.3 Enzymes, Proteins and Nucleic Acids:

- 5.1.3.1 Enzymes and co-enzymes, Co-factors
- 5.1.3.2 Application of enzymes in food industries
- 5.1.3.3 Structure and reactions of amino acids, peptides
- 5.1.3.4 Protein
- 5.1.3.5 Nucleic acids, Biological functions of DNA and RNA
- 5.1.3.6 Regulation of gene expressions and Genetic code

5.2 Applied chemistry

20%

5.2.1 Soil, sediments and rock analysis:

- 5.2.1.1 Soil texture and organic matter in soil
- 5.2.1.2 Cu, Pb, Zn & Ag in soil, sediments and rock
- 5.2.1.3 Acid insoluble matter, loss on ignition, CaO, MgO, total oxide ((Fe₂O₃, Al₂O₃) and SiO₂ in limestone, dolomite and magnesite.

5.2.2 Water, wastewater and air analysis:

- 5.2.2.1 BOD, COD, dissolved oxygen, alkalinity, ammonia, nitrite, nitrate, chloride, phosphate, sulfate, iron, manganese, arsenic and other toxic metals in water and wastewater.
- 5.2.2.2 PM₁₀, TSS, SO₂, CO, CO₂, NO_x in air

5.2.3 Food, food products and feed analysis:

- 5.2.3.1 Proximate analysis (moisture, protein, fat and carbohydrate) of food, food products and feed
- 5.2.3.2 Color detection in food and food products.
- 5.2.3.3 Simple chemical methods (quick test) for detection of food adulteration.
- 5.2.3.4 General concept of Pesticide and pesticide residue analysis in water, soil and foodstuff.

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5.2.4 Analysis of industrial products:

5.2.4.1 Urea

5.2.4.2 Fertilizer

5.2.4.3 Bleaching powder

5.2.4.4 Alcohol

5.2.5 Miscellaneous:

5.2.5.1 Application of chemical methods in preservation of archaeological property.

5.2.5.2 Application of good laboratory practice and ISO 17025 concepts in the quality management.

5.2.5.3 Role of Chemists in Environmental Impact Assessment