

लोक सेवा आयोग
नेपाल इन्जिनियरिङ्ग सेवा, केमिकल इन्जिनियरिङ्ग 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 अंकको 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 । परीक्षार्थीले 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 सम्झनु पर्दछ ।
- प्रथमचरणको परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र द्वितीयचरणको परीक्षामा सम्मिलित गराइनेछ ।
- यस भन्दा अगाडि लागु भएका माथि उल्लेखित सेवा, समूहको पाठ्यक्रम खारेज गरिएको छ ।
- पाठ्यक्रम लागू मिति : २०८०/०७/२०

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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)

- | | | |
|-----------|---|------------|
| 1. | ENGINEERING CHEMISTRY | 10% |
| | 1.1 Purification of organic compounds by crystallization's sublimation & different types of distillation | |
| | 1.2 Preparation & Chemical Properties and uses of : chloroform, carbon tetra chloride, Iodoform, ethanol, ethylene glycol, glycerin, formaldehyde, acetaldehyde, acetone, lactic-, oxalic-, citric-, and succinic acids, diethyl ether, acetoacetic ester, malonic esters | |
| | 1.3 Preparation and industrial uses of organometallic compounds: lead, zinc, lithium, and magnesium organometallic compounds. | |
| | 1.4 Aromatic halogenation, sulphonation, nitration, alkylation, acrylation and addition reactions & their mechanisms | |
| | 1.5 Study of aniline, acetanilide, dimethylaniline. phenol Quinol, benzoic- naphthalene, furan | |
| 2 | PROCESS CALCULATION | 10% |
| | 2.1 Mathematical Techniques in Chemical Engg. | |
| | 2.2 Gas laws and phase equilibrium | |
| | 2.3 Humidity, Saturation and Crystallization | |
| | 2.4 Combustion and Chemical processes | |
| | 2.5 Material balance involving recycles, bypass and purge systems | |
| | 2.6 Thermo physics: Heat capacity calculations | |
| | 2.7 Enthalpy changes of reactions, Dissolution & laws of Thermochemistry | |
| | 2.8 Effect of Pressure & Temperature on heat of reactions | |
| | 2.9 Combined material & energy balances for single stage processes | |
| | 2.10 Material & Energy balance calculations for industrial processes | |
| 3 | FLUID MECHANICS | 10% |
| | 3.1 Properties and classification of fluids | |
| | 3.2 Fluid statics | |
| | 3.3 Velocity field | |
| | 3.4 Stream function | |
| | 3.5 Irrotational flow | |
| | 3.6 Integral and differential analysis for fluid motion: Reynolds' transport theorem | |
| | 3.7 Euler & Bernoulli's equation | |
| | 3.8 Dimensional analysis and similitude | |
| | 3.9 Internal and external fluid flow: friction factor | |
| | 3.10 Energy losses in fittings, valves etc. | |
| | 3.11 Flow measuring devices | |
| | 3.12 Introduction to non-Newtonian fluid | |
| 4 | EQUILIBRIUM STAGE OF OPERATION | 10% |
| | 4.1 Concepts of molecular diffusion and mass transfer coefficient; interphase mass transfer | |
| | 4.2 Equilibrium stage approximation | |
| | 4.3 Conservation relations | |
| | 4.4 Reflux | |
| | 4.5 Constant molal overflow | |
| | 4.6 Batch distillation | |

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- 4.7 Ponchon-Savarit and McCabe- Thiele analysis of binary distillation; introduction to multi-component distillation
- 4.8 Equilibrium solubility of gases in liquids
- 4.9 Counter-current multistage absorption
- 4.10 Multi-component systems; absorption with chemical reaction
- 5 HEAT TRANSFER 10%**
 - 5.1 Differential shell balance
 - 5.2 Steady state heat conduction; electrical analogies
 - 5.3 Transient heat conduction
 - 5.4 Numerical solutions using finite difference
 - 5.5 Transport analogies
 - 5.6 Steady state transport: internal versus external forced convection
 - 5.7 Natural convection
 - 5.8 Radiation heat transfer
 - 5.9 Thermal boundary layer analysis
 - 5.10 Heat transfer coefficient models, including boiling and condensation
- 6 CHEMICAL TECHNOLOGY 10%**
 - 6.1 Raw materials and principles of production of olefins and aromatics;
 - 6.2 Typical intermediates from olefins and aromatics such as ethylene glycol, ethyl benzene, phenol, cumene and DMT, dyes, and pharmaceuticals;
 - 6.3 Chemical manufacturing processes sugar, starch, alcohol, cellulose, paper, glyceride, oils and fats, soaps, detergent, cement, lime, ceramic, leather;
 - 6.4 Industrial processes for the production of inorganic heavy chemicals such as acids, alkalis, salts, and fertilizers such as sulphuric, nitric, and phosphoric acids, soda ash, ammonia, etc.
 - 6.5 Manufacturing of rubber, plastic, fibers, paints
- 7 SAFETY AND WASTE MANAGEMENT 10%**
 - 7.1 Types of hazards in chemical industries, Hazards due to high pressure & explosions, dust & vapor cloud explosions, vacuum temperature, inflammable materials, toxic materials, chemicals, chemical reactions and operations, electrostatics, ionizing radiation etc.
 - 7.2 Noise hazards effects of noise hazards on personnel and plant operation
 - 7.3 Fire & Explosion indices and hazard analysis
 - 7.4 Safety protection, equipment's for personal & plant for various hazards. Safety procedures
 - 7.5 Disaster management, insurance, worker's safety Act etc.
 - 7.6 Sources and effects of environmental pollution, air pollution, water pollution, land pollution, management of industrial waste reuse, recycling, impact of pollution on environment and it's assessment
 - 7.7 Magnitude of industrial waste problem, effluent standards and stream standard
- 8 PETROLEUM REFINERY AND FUEL ENGINEERING 10%**
 - 8.1 Origin and occurrence, composition, classification and physico-chemical properties of petroleum; testing and uses of petroleum products; refining processes such as distillation, cracking, reforming
 - 8.2 Conversion of petroleum gases into motor fuel, aviation fuel; lubricating oils; petroleum waxes
 - 8.3 Chemicals and clay treatment of petroleum products, desulphurization

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- 8.4 Refining operations -dehydration, desalting, gas separation, natural gas production and gas sweetening
 - 8.5 Tube still heater design; product profile of petrochemicals; petrochemical feed stocks
 - 8.6 Olefin and aromatic hydrocarbons production; treatment and upgrading of olefinic C4 and C5 cuts
 - 8.7 Chemicals from C1 compounds, ethylene and its derivatives, propylene and its derivatives, butadiene and butane; BTX chemicals
- 9 POLYMER TECHNOLOGY 10%**
- 9.1 Classification of polymerization reactions such as condensation, free radical, ionic, coordination reactions, their mechanism and rate
 - 9.2 Suspension and emulsion polymerization; copolymerization
 - 9.3 Batch and continuous reactors; different molecular weights with methods of determination
 - 9.4 Molecular weight distribution; crystalline and amorphous structure; viscoelasticity; rubber
 - 9.5 Elasticity; glass transition; production of plastics, rubbers, fibers; polymer theology
 - 9.6 Polymer Processing; analysis using non-Newtonian fluid model
- 10 PROJECT ENGINEERING 10%**
- 10.1 Economics and importance in chemical process industries; interest and equivalence; depreciation and taxes
 - 10.2 Capital investment, cost estimation, and profitability analysis; scale-up principles of equipment
 - 10.3 Plant location and layout and concept of techno- economic feasibility report writing
 - 10.4 Construction of P&I diagram from basic flow diagram and basic engineering of plant design
 - 10.5 Project engineering management; selection of alternatives; selection of plant capacity
 - 10.6 Optimum Project design
 - 10.7 Problems of standardization and commissioning
 - 10.8 Project scheduling
 - 10.9 Use of PERT/CPM techniques