

**लोक सेवा आयोग**  
नेपाल इञ्जिनियरिङ्ग सेवा, केमिकल इञ्जिनियरिङ्ग समूह, राजपत्राङ्कित तृतीय श्रेणीको खुला प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

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

प्रथम चरण :- लिखित परीक्षा पूर्णाङ्क :- २००  
द्वितीय चरण :- अन्तर्वार्ता पूर्णाङ्क :- ४०

**प्रथम चरण – लिखित परीक्षा योजना (Examination Scheme)**

पत्र	विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली	प्रश्न संख्या X अङ्कभार	समय
प्रथम	केमिकल इञ्जिनियरिङ्ग संबन्धी	१००	४०	वस्तुगत बहुवैकल्पिक (Multiple Choice)	१००X१ = १००	१ घण्टा १५ मिनेट
द्वितीय	समूह सम्बन्धी	१००	४०	विषयगत (Subjective)	१०X१० = १००	३ घण्टा

**द्वितीय चरण**

विषय	पूर्णाङ्क	परीक्षा प्रणाली	समय
सामूहिक परीक्षण (Group Test)	१०	सामूहिक छलफल (Group Discussion)	३० मिनेट
व्यक्तिगत अन्तर्वार्ता	३०	मौखिक	-

- लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुन सक्नेछ।
- पाठ्यक्रमको प्रथम र द्वितीय पत्रको विषयवस्तु फरक फरक हुनेछन्।
- प्रथम र द्वितीय पत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ।
- प्रथम तथा द्वितीय पत्रहरूका एकाइहरूबाट सोधिने प्रश्नसंख्या निम्नानुसार हुनेछ :

प्रथम पत्रका एकाई	1	2	3	4	5	6	7	8	9	10
प्रश्न संख्या	10	10	10	10	10	10	10	10	10	10
द्वितीय पत्रका खण्ड	A			B			C		D	
द्वितीय पत्रका एकाई	1	4	5	2	3	6	7	8	9	10
प्रश्न संख्या	1	1	1	1	1	1	1	1	1	1

- 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।
- द्वितीय पत्रमा प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरू हुनेछन्। परिक्षार्थीले प्रत्येक खण्डका प्रश्नहरूको उत्तर सोही खण्डको 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।
- यस भन्दा अगाडि लागू भएको माथि उल्लिखित समूहको पाठ्यक्रम खारेज गरिएको छ।
- पाठ्यक्रम लागू मिति :- २०६३/२ / ९ देखि (२०७२/०७/२४ को निर्णय अनुसार सामूहिक परीक्षण समावेश)।

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परीक्षाको पाठ्यक्रम

प्रथम पत्र :- केमिकल इञ्जिनियरिङ्ग सम्बन्धी

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|----------|---|------------|
| <b>1</b> | <b>ENGINEERING CHEMISTRY</b>  | <b>10%</b> |
|          | 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  |            |
| <b>2</b> | <b>PROCESS CALCULATION</b>  | <b>10%</b> |
|          | 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.   |            |
| <b>3</b> | <b>FLUID MECHANICS</b>  | <b>10%</b> |
|          | 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;   |            |
| <b>4</b> | <b>EQUILIBRIUM STAGE OF OPERATION</b>   | <b>10%</b> |
|          | 4.1 Concepts of molecular diffusion and mass transfer coefficient; interphase mass transfer;  |            |
|          | 4.2 The equilibrium stage approximation;  |            |
|          | 4.3 Conservation relations;   |            |
|          | 4.4 Reflux;   |            |
|          | 4.5 Constant molal overflow;  |            |
|          | 4.6 Batch distillation;   |            |
|          | 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;  |            |

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- 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  
7.8
- 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;  
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;

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- 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

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**वस्तुगत बहुवैकल्पिक नमूना प्रश्नहरु (Sample questions)**

1. First law of thermodynamics deals with  
A) Direction of energy transfer  
B) Reversible processes only  
C) Irreversible process only  
D) None of these **Correct Answer:- (A)**
2. Heat of reaction is  
A) Dependent on pressure only  
B) Dependent on temperature only  
C) Dependent on both pressure and temperature  
D) Independent of temperature changes **Correct Answer:- (C)**
3. A fluid is one which  
A) Cannot remain at rest under the action of shear force  
B) Continuously expands till it fills any container  
C) Is incompressible  
D) Permanently fluid density **Correct Answer:- (A)**
4. Bernoulli's equation describes  
A) Mechanical energy balance in potential flow  
B) Kinetic energy balance in laminar flow  
C) Mechanical energy in turbulent flow  
D) Mechanical energy balance in boundary layer **Correct Answer:- (A)**