

लोक सेवा आयोग
नेपाल इन्जिनियरिङ्ग सेवा, केमिकल इन्जिनियरिङ्ग 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 :- ३०

प्रथम चरण – लिखित परीक्षा योजना (Examination Scheme)

पत्र	विषय	पूर्णाङ्क	उत्तीर्णाङ्क	परीक्षा प्रणाली	प्रश्न संख्या X अङ्कभार	समय
प्रथम	केमिकल इन्जिनियरिङ्ग संबन्धी	१००	४०	वस्तुगत बहुउत्तर (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
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 हुनेछन ।
- 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

- प्रथम पत्रमा वस्तुगत बहुउत्तर (Multiple Choice) प्रश्नहरूको उत्तर सही दिएमा प्रत्येक सही उत्तर बापत १ (एक) अङ्क प्रदान गरिनेछ भने गलत उत्तर दिएमा प्रत्येक गलत उत्तर बापत २० प्रतिशत अर्थात् ०.२ अङ्क कट्टा गरिनेछ । तर उत्तर नदिएमा त्यस बापत अङ्क दिइने छैन र अङ्क कट्टा पनि गरिने छैन ।
- द्वितीय पत्रको 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 पत्रको पाठ्यक्रमलाई ४ वटा खण्ड/एकाईमा विभाजन गरिएको छ, ४ वटा खण्ड/एकाईको लागि ४ वटै उत्तरपुस्तिका दिइनेछ र परीक्षार्थीले प्रत्येक खण्ड/एकाईका प्रश्नहरूको उत्तर सोही खण्ड/एकाईको उत्तर पुस्तिकामा लेख्नु पर्नेछ ।
- यस पाठ्यक्रममा जेसुकै लेखिएको भएता पनि पाठ्यक्रममा परेका ऐन, नियमहरू परीक्षाको मिति भन्दा ३ (तीन) महिना अगाडि (संशोधन भएका वा संशोधन भई हटाइएका वा थप गरी संशोधन भई) कायम रहेकालाई यस पाठ्यक्रममा रहेको सम्झनु पर्दछ ।
- प्रथम चरणको लिखित परीक्षाबाट छनौट भएका उम्मेदवारहरूलाई मात्र द्वितीय चरणको अन्तर्वार्तामा सम्मिलित गराइनेछ ।
- यस भन्दा अगाडि लागू भएको माथि उल्लिखित समूहको पाठ्यक्रम खारेज गरिएको छ ।
- पाठ्यक्रम लागू मिति :- २०६३/२ / ९ देखि

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परीक्षाको पाठ्यक्रम

प्रथम पत्र :- केमिकल इन्जिनियरिङ्ग सम्बन्धी

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|----------|---|------------|
| 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 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; | |
| | 4.10 Multi-component systems; absorption with chemical reaction | |

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| 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; | |
| | 8.7 Chemicals from C1 compounds, ethylene and its derivatives, propylene and its derivatives, butadiene and butane; BTX chemicals. | |

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| 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 | |

वस्तुगत बहुउत्तर नमूना प्रश्नहरू (Sample questions)

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|----|--|-----------------------------|
| 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) |