प्रदेश लोक सेवा आयोग,

प्रदेश नं. ५, बुटवल, रुपन्देही

प्रदेश इञ्जिनियरिङ्ग सेवा मेकानिकल समूह अन्तर्गतका जनरल मेकानिकल र निर्माण उपकरण संभार उपसमूहहरुको अधिकृतस्तर सातौं तहका पदहरुको 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	उर्तीर्णाङ्क	परीक्षा प्रणाली		प्रश्नसंख्या X अङ्क	समय
प्रथम	General Subject	Part I: General Awareness & General Ability Test	१००	४०	वस्तुगत (Objective)	बहुवैकल्पिक प्रश्न (MCQs)	५० प्रश्न X १ अङ्क	१घण्टा ३० मिनेट
		Part II: General Technical Subject					५० प्रश्न X१ अङ्क	
द्वितीय	Technical Subject		१००	४०	विषयगत (Subjective)	छोटो उत्तर लामो उत्तर	४ प्रश्न × ५ अङ्क ८ प्रश्न × १०अङ्क	३ घण्टा

द्वितीय चरण : सामूहिक परीक्षण (Group Test) र अन्तर्वार्ता (Interview) पूर्णाङ्क :– ४०

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

द्रष्टव्य :

१. लिखित परीक्षाको माध्यम भाषा नेपाली वा अंग्रेजी अथवा नेपाली र अंग्रेजी दुवै हुनेछ ।

२. प्रथमपत्र र द्वितीयपत्रको लिखित परीक्षा छुट्टाछुट्टै हुनेछ ।

३. 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 ।

४. बहुवैकल्पिक प्रश्नहरु हुने परीक्षामा कुनै प्रकारको क्याल्कुलेटर (Calculator) प्रयोग गर्न पाइने छैन ।

५. विषयगत प्रश्नहरुको 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 टिप्पणीहरु (Short notes) सोध्न सकिने छ ।

६. द्वितीय पत्रमा (विषयगत प्रश्न हुनेका हकमा) प्रत्येक खण्डका लागि छुट्टाछुट्टै उत्तरपुस्तिकाहरु हुनेछन् । परिक्षार्थीले प्रत्येक खण्डका प्रश्नहरुको उत्तर सोहीखण्डको उत्तरपुस्तिकामा लेख्नुपर्नेछ ।

७. यस पाठ्यक्रम योजना अन्तर्गतका पत्र/विषयका विषयवस्तमा जेसुकै लेखिएको भए तापनि पाठ्यक्रममा परेका विद्यमान कानून, ऐन, नियम तथा नीतिहरुलाई यस पाठ्क्रममा परेको सम्झन पर्दछ ।

८. प्रथमचरणको परीक्षाबाट छनौट भएका उम्मेदवारहरुलाई मात्र द्वितीयचरणको परीक्षामा सम्मिलित गराइनेछ ।

९. पाठयक्रम लागू मितिः - २०७७।०६।०२ देखि

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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 Ability Test** **(25 ×1 Mark = 25 Marks)**

   2.1 **Verbal Ability Test** (8×1 Mark = 8 Marks)

   Jumble words, Series, Analogy, Classification, Coding-Decoding, Matrix, Ranking Order Test, Direction and Distance Sense Test, Common Sense Test, Logical Reasoning, Assertion and Reason, Statement and Conclusions

   2.2 **Numerical Ability Test** (9×1 Mark = 9Marks)

   Series, Analogy, Classification, Coding, Arithmetical reasoning/operation,

   Percentage, Ratio, Average, Loss & Profit, Time & Work, Data interpretation & Data verification

   2.3 **Non-verbal/Abstract Ability Test** (8×1 Mark = 8 Marks)

   Figure Series, Figure Analogy, Figure Classification, Figure Matrix, Pattern Completion/Finding, Analytical Reasoning Test, Figure Formation and Analysis,

   Rule Detection, Water images, Mirror images, Cubes and Dice &Venn-diagram

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

1. **Material Science and Metallurgy** **(5 marks)**
   - 1.1 Types of materials and material selection
   - 1.2 Imperfections in atomic arrangement: Slip and twinning, dislocation, points and surface defects
   - 1.3 Mechanical properties and testing: Tension, impact, fatigue and hardness tests
   - 1.4 Cold working and hot working
   - 1.5 Types of steel
   - 1.6 Phase transformation and heat treatment: Iron-carbon equilibrium diagram, hardening, tempering, annealing and normalizing

2. **Fluid Mechanics** **(5 marks)**
   - 2.1 Fluid properties: Viscosity, surface tension, compressibility, Vapor Pressure
   - 2.2 Fluid statics: Pressure variations in static fluid, pressure head, manometer, force on submerged surfaces
   - 2.3 Equations of fluid flow: Types of flow, continuity equation, Bernoulli's equation, and momentum equation
   - 2.4 Viscous effects: Reynold’s number, boundary layer, frictional resistance to flow in pipes
   - 2.5 Flow measurement: Pitot-static tube, orifice, venturimeter, nozzle, rotameter

3. **Thermodynamics and Heat Transfer** **(10 marks)**
   - 3.1 Basic concepts: Thermodynamic system, thermodynamic property, pure Substance, laws of thermodynamics, heat engine, refrigerator and heat pump
   - 3.2 Refrigeration: Reversed Carnot cycle, vapor compression cycle, absorption refrigeration systems, refrigerants and their properties
   - 3.3 Air Conditioning: Psychometric properties and psychometric chart, heating, cooling, humidification and dehumidification process, air conditioning systems
   - 3.4 Thermodynamic cycles: Carnot cycle, Otto cycle, Diesel cycle, Brayton cycle, Rankine cycle
   - 3.5 IC engines: Classifications, components, two-stroke and four-stroke operations, performance of IC engines
   - 3.6 Modes of heat transfer: Conduction, convection and radiation

4. **Workshop Technology and Metrology** **(5 marks)**
   - 4.1 Machine tools operation and application: Lathe, shaper, milling, grinding, drilling machines
   - 4.2 Metal joining operation and application: Oxy-acetylene welding and arc welding
   - 4.3 Limits, fits, tolerances and gauges
   - 4.4 Linear measurement: Block Gages, length bars, comparators
   - 4.5 Angular measurement: Bevel protractor, sine bar, spirit level, clinometers and angle gauges
   - 4.6 Errors in measurement

5. **Advance Machines and Machining Techniques** **(5 marks)**

5.1 Numerical Control (NC) and Computer Numerical Control (CNC) machines,CNC machine tools, machine control units, general introduction to CNC programming

5.2 Modern Machining techniques: Ultrasonic machining, abrasive jet machining, abrasive water jet machining, electro chemical machining, electrical discharge machining, laser beam machining, electron beam machining, plasma arc machining

6. **Hydraulic and Electric Machines** **(8 marks)**

6.1 Working principle and characteristic of water turbines: Pelton, Francis, Kaplan and Cross flow turbines

6.2 Working principle and Characteristic of Pumps: Centrifugal pump and Reciprocating pump, Hydraulic ram

6.3 DC Motors: Shunt field, Series field and Compound field motors, Torque- speed characteristics

6.4 DC Generators: Shunt, Series and Compound field machines, Voltage/speed/load characteristics, Effects of variable load, variable torque

6.5 Synchronous and Induction Machines: Basic structure of synchronous machines, Generator on isolated load, Generator on large system, Synchronous motor

6.6 Power Station Practice

7. **Instrumentation and Control** **(5 marks)**

7.1 Basic concepts of control system: Classification, transfer function, block diagram and signal flow graph

7.2 Sensors and transducers: Mechanical detector-transducer elements, resistance, variable inductance, mutual inductance, capacitive, piezo-electric, linear variable differential, thermoelectric, Hal effect, photo electric and photo emissive transducers, strain gauges

7.3 Basic concepts of microprocessors and microcontrollers and their applications

7.4 Basic Boolean algebra and numbering systems, basic logic gates

7.5 Control system: Components, derivative, proportional and integral controllers and their combinations, hydraulic and pneumatic control systems, response characteristics of control systems

8. **Automobile Engineering** **(7 marks)**

8.1 Classification of automobiles and their features, parts and components of engine

8.2 Fuel Systems: Fuel system for petrol engine, fuel injection for diesel engine, petrol fuel injection system

8.3 Cooling and lubrication systems for engines

8.4 Electrical system : Battery, ignition system, charging system, accessories

8.5 Chassis layout and frames, suspension system, wheels, tyres and brake

8.6 Transmission system and steering system

8.7 Automobile emission and its control: combustion, constituents of exhaust, effect of air fuel ratio and driving mode, control of automobile emission

8.8 Automobile service stations and service procedure: types of service stations, location and lay out, equipment, tools, service procedures

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द्वितीयपत्र (Paper II) : Technical Subject

Section (A) - 20 Marks

1. **Machine Design and Drawing**
   - 1.1 Design analysis: Types of loads and stresses, theories of failure, factor of safety.
   - 1.2 Design of machine components: Design of parts subjected to tension, compression, shear, bending, design of shafts, keys, splines, couplings, fasteners, power screws, helical compression springs, knuckle joints, riveted joints and welded connections.
   - 1.3 Design of power transmission elements: Belt drives, selection of flat and V belts, design of pulleys and flywheels, design of gear drives, spur, helical, bevel and worm gear drives.
   - 1.4 Design of bearings: Hydrodynamic journal bearings, pressure fed and selfcontained bearings and rolling contact bearings
   - 1.5 Load lifting devices: Selection of steel wire ropes for hoists and cranes, crane hooks, design of hook block, sheaves and rope winding drums.
   - 1.6 Pressure vessels: classification, material selection, loads and types of failures.
   - 1.7 Types of projections, production drawings, Computer Aided Design
   - 1.8 Design standardization: Importance of standardization, international organizations for standardization

Section (B) - 30 Marks

2. **Industrial Engineering**
   - 2.1 Plant location and layout: Factors affecting location of factory plant building and service facilities, product or line layout, process or functional layout and fixed position layout
   - 2.2 Production planning and inventory control: Forecasting techniques- time series, moving average, exponential smoothing, trend and seasonality. Inventory- functions, cost, classification, deterministic and probabilistic inventory models
   - 2.3 Operation research: Linear programming, problem formulation, simplex method, duality and sensitivity analysis, transportation and assignment models, PERT and CPM methods of project management
   - 2.4 Quality Management: Concept of quality, statistical quality control, acceptance sampling, zero defects, six sigma, quality circle, quality assurance, total quality management
   - 2.5 Ergonomics: Productivity and working environment, man-machine systems, illumination, noise and vibration, ventilation, air conditioning, temperature control, anthropometry, work-space layout
   - 2.6 Safety: Workplace hazards and risks, hazard identification and risk assessment, risk control, causes and prevention of accidents, fire prevention and firefighting equipment, electrical safety, safe handling of chemicals, material handling and material safety data sheets

3. **Maintenance Management**

3.1 Maintenance: Reliability, maintainability, total life cycle, routine, fixed time, break down and shut down maintenance, maintenance work load and budget, documentation and recording, maintenance audit

3.2 Preventive and Predictive maintenance: Condition monitoring, signature analysis, online and off-line maintenance, non-destructive test, wear particles and oil analysis, thermography, scanning electron microscope

3.3 Corrosion: Types of corrosion, corrosion testing, control and prevention

3.4 Tribology: Surfaces, friction and wear, lubrication, surface topography measurement

3.5 Total Productive Maintenance (TPM): Types of losses, measures to control losses, basics of TPM, cost estimation and safety measures

Section (C) - 20 Marks

4. **Environmental engineering**

4.1 Air Pollution: Pollution from combustion and atmospheric pollution, types of pollutants, sources of pollutants, particulate control, control of gaseous pollutants, indoor air pollution control

4.2 Noise Pollution: Measurement of noise, noise control

4.3 Water Pollution: Causes and effects, Waste water treatment

4.4 Solid Waste Management: Recycling, energy recovery, incineration, land filling

4.5 Global impacts: Green-House Effect, acid rain, climate change, ozone layer depletion

5. **Energy Resources**

5.1 Energy consumption scenario of Nepal, commercial and non-commercial energy resources

5.2 Hydroelectricity, national potentials, achievements and utilization

5.3 Solar energy and its applications: Solar thermal, solar photovoltaic

5.4 Biomass energy, wind energy

5.5 Methods of enhancing energy efficiency & energy conservation

Section (D) - 30 Marks

6. **Engineering Economics**

6.1 Time Value of Money: Simple interest, Compound interest, Continuous compound interest

6.2 Project Evaluation Techniques: Payback period method, NPV method, Future value analysis, IRR method

6.3 Benefit and Cost Analysis: Cost benefit ratio, breakeven analysis, make or buy decision

6.4 Engineering economics decisions

6.5 Corporate tax system in Nepal

6.6 Depreciation and its types

7. Professional Practice

7.1 Ethics and Professionalism: Perspectives on morals, codes of ethics and guidelines of professional engineering practice, Nepal Engineering Council Act and Rules

7.2 Contract Act and Rules

7.3 Procurement and procurement procedure, Public Procurement Act, Rules and Guidelines in Nepal

7.4 Introduction to Intellectual Property: copy right, trademark, industrial design, patent, unfair competition, World Intellectual Property Organization (WIPO)

8. Construction Equipment, Planning and Management

8.1 Construction equipment, their types and uses: Earthmoving equipment, Hauling equipment, Hoisting equipment, Finishing equipment, Drilling equipment, Blasting equipment, Tunneling equipment, Pile driving equipment

8.2 Equipment life and replacement procedures: Physical life, profit life, economical life, replacement analysis, replacement decision making

8.3 Planning of equipment: Equipment selection, fleet standardization, resources management for operation, maintenance and service facilities

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