लोक सेवा आयोग

नेपाल इञ्जिनियरिङ्ग सेवा, सिभिल समूह, हाइड्रोपावर उपसमूह, राजपत्राङ्कित द्वितीय श्रेणी, खुला र आन्तरिक प्रतियोगितात्मक परीक्षाको पाठ्यक्रम

द्वितीय पत्र :

**Technical Subject (Civil Engineering - Hydropower)**

**Section (A)**

## 1. Water Resources Development and Management

1.1 Availability and use of water resources in Nepal, in the neighborhood and in the world

1.2 Historical and current trend in water resources development and management practices

1.3 Process and studies & investigations involved in the formulation and periodic revision of country's river basin plans and hydropower development master plans; significance and legal basis concerning implementation of these plans

1.4 Strategic environmental assessment and its use in the formulation of above stated basin plan and master plan

1.5 International treaties and agreements on water and power to which Nepal is a party

1.6 Climate change, its impact on water resources and options for resilience

## 2. Hydropower Development and Management

2.1 Potential and development of hydropower in Nepal

2.2 Power sector institutions: regulating and government institutions, public and private sector investors in generation, transmission and distribution businesses, domestic and cross-border market players and traders; concept of power sector reform and related institutional restructuring

2.3 Opportunities and constraints in hydropower development in Nepal

2.4 Aspects of cross-border electricity trade

2.5 Energy generation mix scenario of Nepal

2.6 Energy security policy, alternative energy and energy efficiency

**Section (B)**

## 3. Hydropower Engineering and Design

3.1 Basic parameters of hydropower engineering: load curves, load factor, capacity factor, utilization factor, diversity factor, load/power duration curves, firm power, secondary power, dump power

3.2 Site investigations and treatment: various geological and geophysical investigations of hydropower sites in general; investigation of sites by electric conductivity test and drilling in detail; types and methods of foundation treatment and seepage control by grouting and stability improvement by rock-bolting

3.3 Dams and spillways: dam types; load considerations, design and safety check of concrete gravity and zoned embankment dams; freeboard requirements; spillway types; design considerations and design of ogee overflow, side channel and chute spillways; aeration devices

3.4 Life and operation of a storage reservoir: reservoir sedimentation process; estimation of reservoir life, power routing; rule curve and emergency operation

3.5 Energy dissipators: types and design of standard energy dissipators used in various situations

3.6 Intake structures: types and functions; design of power canal head regulators and tunnel intakes and trash-racks

3.7 Settling basin and desanders: theories concerning transportation, suspension and settlement of sediments; design of settling basins/desanders for continuous and intermittent flushing arrangements

3.8 Conveyance systems: design of power canal including lining and pressure relief valves; excavation methods and problems encountered in tunnel construction; design of steel support, lining and treatment in hydropower tunnels; functions, types and design considerations in forebay and surge tanks and penstocks; economic considerations in the design of conveyance system

3.9 Powerhouse: components and layout design of various types of powerhouses; types of draft tubes and their design; head-loss and efficiency of a draft tube; setting of a turbine

3.10 Hydraulic turbines: basic hydraulic theories related to various types of turbines; selection of number and type of turbine; design of a turbines; governing of turbines

3.11 Prevailing guidelines in the study of hydropower projects

## Section (C)

**4. Hydropower Project Planning and Investigation**

4.1 Planning parameters and data: types of data and sources for a hydropower project planning

4.2 Studies related to power market and evacuation

4.3 Investigations at reconnaissance, prefeasibility, feasibility and detailed design phases with varying details: topographical survey and mapping; hydrological and sedimentation studies; geological, geotechnical and seismic studies; construction material survey; disaster risk analysis

4.4 Developing alternatives and selection of type and site: headwork/dam/spillway; conveyance system including intake, headrace, surge tank, penstock, etc.; powerhouse complex including surface/underground, number and size of units, draft tube, switchyard, etc.; tailrace

4.5 Project layouts in both single purpose hydropower and multipurpose water resources projects

4.6 Temporary river diversion

4.7 Methods of cost apportionment in multipurpose projects

4.8 Determination of necessary environmental flow

4.9 Preparation of environment management plan and resettlement and rehabilitation plan

4.10 Methods and bases of cost and benefit estimates

## Section (D)

**5. Hydropower Project Implementation and Operation**

5.1 Project development/investment under: public sector, private sector, public-private partnership, community and crowd funding

5.2 Roles and functions of quasi-judicial regulator, government, investor, power offtaker, wheeler (transmission company), system operator, power trader, multilateral development partners, guarantors, lenders; consultants, panels of experts for the review of design, construction and troubleshooting, construction and O & M contractors, insurers; and standard features and provisions of the legal instruments between two or more of these entities – such as licenses and permits, concession/project development agreement, power purchase agreement, transmission and connection agreement, loan agreement, trade agreement, various financial obligation guarantees, etc., in the context of hydropower development and management

5.3 Project preparation, construction, commissioning and operation & maintenance and handover to the government

**6. Hydropower Project Financing**

6.1 Foreign exchange and other risks and their coverage, Hedging funds and financial adjustments

6.2 Detailed understanding of various hydropower project finance related arrangements and terms: capitalized interest, equity and debt, escrow account, financial close, front loading of debt service, functioning of spot market of electricity, interest during construction, marginal cost of capital, mezzanine financing, non-recourse, limited recourse and recourse financing, power bond, project cashflow, return on equity, refinancing of project, syndicated loan, transaction advisory services

**7. Electricity tariff determination**

7.1 Principles

7.2 Tariff design and rate cases

7.3 Tariff determination process

## Section (E)

**8. Service/Group/Sub-group related- Specific (Acts, Rules and Policies)**

8.1 जलस्रोत ऐन, २०४९ र जलस्रोत नियमावली, २०५०

8.2 विद्युत ऐन, २०४९ र विद्युत नियमावली, २०५०

8.3 नेपाल विद्युत प्राधिकरण ऐन, २०४१

8.4 विद्युत नियमन आयोग ऐन, २०७४

8.5 विद्युत विकाष कोष समिति (गठन) आदेश, २०६०

8.6 वन ऐन, २०७६ र वन नियमावली, २०७७

8.7 राष्ट्रिय निकुञ्ज ऐन, २०२९ र राष्ट्रिय निकुञ्ज नियमावली, २०३०
8.8 औद्योगिक व्यवसाय ऐन, २०७६
8.9 औद्योगिक नीति, २०६७
8.10 राष्ट्रिय जलस्रोत नीति, २०७७
8.11 जल-विद्युत विकास नीति, २०५८ (Hydropower Policy, 2001
8.12 राष्ट्रिय जल योजना, २०६२ (National Water Plan, 2005)
8.13 जलस्रोत रणनीति, २०५८ (National Water Strategy, 2002)
8.14 Green Hydrogen Policy, 2080

**नोट :** यस पत्रमा माथि उल्लिखित पाठ्यक्रमको खण्ड (E) बाहेकका प्रत्येक खण्ड (Section) बाट कम्तीमा **एक प्रश्न** समावेश हुने गरी लिखित परीक्षामा देहाय बमोजिमको संख्या र अङ्कभारका प्रश्नहरु सोधिने छ । तर खण्ड (E) बाट ५ अङ्कभारको छोटो उत्तर आउने एक प्रश्न र १० अङ्कभारको लामो उत्तर आउने एक प्रश्न गरी **दुई प्रश्नहरु** सोधिने छ ।

| पत्र | विषय | पूर्णाङ्क | उर्तीर्णाङ्क | परीक्षा प्रणाली | प्रश्न संख्या × अङ्क | समय |
|---|---|---|---|---|---|---|
| द्वितीय | Technical Subject | १०० | ४० | विषयगत (Subjective) | 1 ×5 & 1 ×10 = 15 (Short & Long Answers)<br>3× 15 = 45 (Critical Analysis)<br>2×20 = 40 (Problem Solving) | ३ घण्टा |

पाठ्यक्रम लागू मिति :- **२०८१/०३/३० देखि**