

**Far Western University
Service Commission**

Syllabus 2081

Special Internal Competition for the Post of Instructor

Subject: Civil Engineering

Full Marks 50

Paper: II

Time: 2 hrs

This paper will include questions to assess the subject-specific or content knowledge of the candidates. Questions will be asked from the following content areas that are covered in the curricula of the Bachelor's and Master's degree programs. The distribution of questions will be as follows:

- 1) Long Answer Questions – 3 questions x 10 Marks = 30 Marks
- 2) Short Answer Questions – 2 Questions x 10 Marks = 20 Marks (Each short answer question will have 2 questions with 5 marks each)

1. Materials, Concrete and Soil Mechanics

Construction Materials

Properties of building materials: physical, chemical, constituents, thermal. Stones- characteristics and requirements of stones as a building materials. Bricks: Composition, manufacturing process, types, defects, bonds and testing. Ceramic materials: Ceramic tiles, mosaic tile. Cementing materials: Types and properties of lime and cement; cement mortar tests. Metals: Steel; types and properties; alloys. Timber and wood: timber trees in Nepal, types and properties of wood. Miscellaneous materials: Asphaltic materials (Asphalt, Bitumen and Tar); paints and varnishes; polymers.

Concrete Technology

Constituents and properties of concrete (physical and chemical), water cement ratio, grade and strength of concrete, concrete mix design, testing of concrete, mixing, transportation pouring and curing of concrete; admixtures, high strength concrete

Soil Mechanics and Foundation

Soil properties and its parameters, index properties, permeability of soil, tests, compaction and consolidation. Bearing capacity evaluation of soils, simple foundation design.

2. Structure Analysis and Design

Structural Analysis

Stresses and strains; moment of inertia, theory of flexure and torsion; bending moment, shear force and deflection of beams and frames, virtual work method, energy methods; three hinged systems, indeterminate structures: Slope deflection method and moment distribution method; use of influence line diagrams for simple beams.

Reinforced Concrete (RC) Design

Design philosophy, analysis of RC beams and slabs in bending, shear, deflection, bond and end anchorage, design of axially loaded columns; isolated and combined footings.

Steel and timber structures

Standard and built-up sections: Design of bolted and welded connections, design of simple elements such as ties, struts, axially loaded and eccentric columns, column bases. Stresses in timber species, design of timber beams and columns.

3. Engineering Survey

Introduction and basic principles. Linear measurements: Techniques; chain, tape, ranging rods and arrows; representation of measurement and common scales; sources of errors; effect of slope and slope correction; correction for chain and tape measurements; Abney level and clinometers. Compass survey: Bearings; types; problems and sources of errors. Plane Table: Principles and methods of plane tabling. Leveling and contouring: Principle of leveling; temporary and permanent adjustment of level; bench marks; booking methods and their reductions; longitudinal and cross sectioning; reciprocal leveling; trigonometric leveling; contour interval and characteristics of contours; methods of contouring. Theodolite traversing: need of traverse and its significance; computation of coordinates; adjustment of closed traverse; closing errors. Total station and photogrammetric survey.

Building Technology

Present status and practices of building construction in Nepal. Components of buildings, their functions and strength, considerations in design and construction of buildings in Nepal. Indigenous technology in building design and construction. Local and Modern building construction material in Nepal.

4. Construction Management

Construction scheduling and planning: network techniques (CPM, PERT) and bar charts; contractual procedure and management: types of contract, tender and tender notice, preparation of bidding (tender) document, contractors pre-qualification, evaluation of tenders and selection of contractor, contract acceptance, condition of contract; quotation and direct order, classifications of contractors; dispute resolution; muster roll. Material management: Procurement procedures and materials handling Cost control and quality control. Project maintenance. Occupational health and safety. Project monitoring and evaluation. Quality assurance plan. Variation, alteration and omissions.

Estimating and Costing Valuation and Specification

Types of estimates and their specific uses; methods of calculating quantities. Key components of estimating norms and rate analysis. Preparation of bill of quantities. Purpose, types and importance of specification. Purpose, principles and methods of valuation

5. Engineering Economics

Benefit cost analysis, cost classification, sensitivity analysis, internal rate of return, time value of money; economic equilibrium, demand, supply and production, net present value, financial and economic evaluation.

Professional Practices

Ethics and professionalism: code of conduct and guidelines for professional engineering practices.

- a. Nepal Engineering Council Act, 2055 and regulations, 2056
- b. Relation with clients, contractor and fellow professionals
- c. Public procurement practices for works, goods and services and its importance

6. Transportation Engineering

Transportation system and its classification. Transportation planning: rationale, types and its philosophy. Road transport and road construction in Nepal. Classification of roads in Nepal

(NRS and IRC). General principles of road network planning. Feasibility study of road projects. Alignment, engineering survey and its stages.

Geometric design of roads: map study, element of cross-section and highway alignment, design of horizontal curve, super elevation, transition curve, vertical curves, right of way.

Drainage consideration in roads: Introduction and design of culverts and minor bridges, cross drainage structures, subsurface drainage system.

Special consideration in Hill roads design: Problems associated with hill roads construction. Route location, hairpin bends and special structures. Bioengineering practices along hill side. Activities and techniques in road construction in rural roads. Role of social mobilization in rural road development. Role of social mobilization in rural road development.

Road Pavement: Types of pavement and their applicability in hill roads, Design of pavement. Maintenance, repair and rehabilitation of roads.

Basic knowledge on design, construction and maintenance of suspended and suspension bridge in Nepal. Low-cost road construction.

7. Water Supply and Sanitation

Rural and community based water supply system; Water supply sources and their management. Surface water, ground water, selection of source. Water quality and treatment, water demand and supply, source protection. Intakes, collection chamber and break pressure tanks. Reservoir and distribution system. Intakes, pipeline design, design of transmission and distribution system, reservoir design. Pipe and fittings: Pipe materials, pipe laying and fittings. Operation and maintenance of water supply systems. Sanitation, wastewater and solid waste management: On-site sanitation system, types of sewerage system, design and construction of sewers. Types, characteristics, sources, quantity, generation, collection, transportation and disposal of solid wastes. Sanitary landfill, incineration, composting etc. Environmental health engineering- Epidemiology, pathogens (Bacteria, Virus, Helminthes, Protozoa)

8. Energy System

Hydrological study, planning and design of small hydropower projects. Head works, dams, spillways, surge tanks, stilling basin etc. River diversion works. Alternative energy systems in Nepal. Irrigation and River training works. Status of irrigation development in Nepal. Methods of irrigation and their suitability. Design of irrigation canals. Operation and maintenance of irrigation systems. Management of Farmers managed irrigation system. Preventive and remedial measures of water logging. Flood control, its necessity and flood mitigation measures. River training works. Specific considerations in design, operation and management of hill irrigation systems

Model Questions

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Attempt all questions

Long Answer Questions: 3 x 10 Marks = 30 Marks)

1. Design a simply supported RCC beam of span 8 m to carry a dead load of 8 kN/m and a live load of 10 kN/m using the Limit State Method.

Use M20 concrete and Fe 500 steel.

Show the calculation of bending moment, shear force, section design, and reinforcement detailing.

Draw a neat sketch showing ductile detailing requirements as per relevant codes.

2. Mention the methods of flexible pavement design. Critically analyze the provisions of Nepal Road Standards (NRS) for flexible pavement design. Also, explain the material tests required for pavement design and justify their importance.

3. Explain the water treatment processes adopted in a city water supply system.

Discuss the physical, chemical, and bacteriological tests carried out to confirm the quality of treated water, with reasons.

4. a What are the major errors in theodolite traversing? Briefly explain the methods of adjustment of these errors.

b. Mention the major laboratory tests conducted in Engineering Materials and Geotechnical Engineering at the Bachelor level. Suggest two measures to conduct these laboratory classes effectively.

5.a Define total pressure and center of pressure. A rectangular plate of size 5 m × 2 m is immersed vertically in water such that its 5 m side is parallel to the water surface and the top edge is 2 m below the water surface. Calculate the total pressure acting on the plate.

b. Analyze the current status of occupational health and safety (OHS) in Nepalese construction projects. Suggest practical improvement measures.