

#### 4. Hydraulics

##### 4.1 General

4.1.1 Properties of fluid: mass, weight, specific weight, density, specific volume, specific gravity, viscosity

4.1.2 Pressure and Pascal's law

##### 4.2 Hydro-Kinematics and Hydro-Dynamics

4.2.1 Energy of flowing liquid: elevation energy, Kinetic energy, potential energy, internal energy

##### 4.3 Measurement of Discharge

4.3.1 Weirs and notches

4.3.2 Discharge formulas

##### 4.4 Flows: Characteristics of pipe flow and open channel flow

#### 5. Soil Mechanics 5.1

##### General

5.1.1 Soil types and classification

5.1.2 Three phase system of soil

5.1.3 Unit Weight of soil mass: bulk density, saturated density, submerged density and dry density

5.1.4 Interrelationship between specific gravity, void ratio, porosity, degree of saturation, percentage of air voids air content and density index

##### 5.2 Soil Water Relation

5.2.1 Terzaghi's principle of effective stress

5.2.2 Darcy's law

5.2.3 Factors affecting permeability

##### 5.3 Compaction of soil

5.3.1 Factors affecting soil compaction

5.3.2 Optimum moisture content

5.3.3 Relation between dry density and moisture content

##### 5.4 Shear Strength of Soils

5.4.1 Mohr-Coulomb failure theory

5.4.2 Cohesion and angle of internal friction



## 5.5 Earth Pressures

- 5.5.1 Active and passive earth pressures
- 5.5.2 Lateral earth pressure theory

### 5.5.3 Rankine's earth pressure theory

## 5.6 Foundation Engineering

### 5.6.1 Terzaghi's general bearing capacity formulas and their application

## 6. Structures

### 6.1 R.C. Sections in Bending

#### 6.1.1 Under reinforced, over reinforced and balanced sections

#### 6.1.2 Analysis of single and double reinforced rectangular sections 6.2

### Shear and Bond for R.C. Sections

#### 6.2.1 Shear resistance of a R.C. section

#### 6.2.2 Types of Shear reinforcement and their design

#### 6.2.3 Determination of anchorage length

### 6.3 Design and Working System of R.C. Structures

#### 6.4.1 Singly and doubly reinforced rectangular beams

#### 6.4.2 Simple one-way and two-way slabs

#### 6.4.3 Axially loaded short and long columns

## 7. Building Construction Technology

### 7.1 Foundations

#### 7.1.1 Subsoil exploration

#### 7.1.2 Type and suitability of different foundations: Shallow, deep

#### 7.1.3 Shoring and dewatering

#### 7.1.4 Design of simple brick or stone masonry foundations 7.2 Walls

#### 7.2.1 Type and thickness of walls

#### 7.2.2 Use of scaffolding

### 7.3 Damp Proofing

#### 7.3.1 Source of Dampness

#### 7.3.2 Remedial measures for damp proofing

### 7.4 Concrete Technology

#### 7.4.1 Constituents of cement concrete

#### 7.4.2 Grading of aggregates



7.4.3 Concrete mixes

7.4.4 Water cement ratio

7.4.5 Factors affecting strength of concrete

7.4.6 Form work

7.4.7 Curing

7.5 Wood work

7.5.1 Frame and shutters of door and window

7.5.2 Timber construction of upper floors

7.5.3 Design and construction of stairs

7.6 Flooring and Finishing

7.6.1 Floor finishes: brick, concrete, flagstone

7.6.2 Plastering

## **8. Water Supply and Sanitation Engineering**

8.1 General

8.1.1 Objectives of water supply system

8.1.2 Source of water and its selection: gravity and artisan springs, shallow and deep wells; infiltration galleries

8.2 Gravity Water Supply System

8.2.1 Design period

8.2.2 Determination of daily water demand

8.2.3 Determination of storage tank capacity

8.2.4 Selection of pipe

8.2.5 Pipe line design and hydraulic grade line

8.3 Design of Sewer

8.3.1 Quantity of sanitary sewage

8.3.2 Maximum, Minimum and self cleaning velocity

8.4 Excreta Disposal and Unsewered Area

8.4.1 Pit latrine

8.4.2 Design of septic tank



## **9. Irrigation Engineering**

### **9.1 General**

9.1.1 Need for irrigation; advantages of irrigation

9.1.2 Sources of irrigation: water, river & streams, ground water and others

9.1.3 Methods of irrigation: surface, sub-surface and others

### **9.2 Irrigation Water Requirement**

9.2.1 Crop season, principal crops, and crop water requirements

9.2.2 Base period & duty

### **9.3 Irrigation Canals**

9.3.1 Canal losses and their minimization

9.3.2 Irrigation requirements and design discharge of canal permissible velocities for different canals

9.3.3 Design of canal based on Manning's & Lacey's formulae

9.3.4 Need and location of escapes

9.3.5 Components of distribution system

## **10. Highway Engineering**

### **10.1 General**

10.1.1 Introduction to transportation systems

10.1.2 Historic development of roads

10.1.3 Classification of road in Nepal

10.1.4 Basic requirements of road alignment

### **10.2 Geometric Design**

10.2.1 Basic design control and criteria for design

10.2.2 Elements of cross section, typical cross-section for all roads in filling and cutting

10.2.3 Camber

10.2.4 Determination of radius of horizontal curves

10.2.5 Superlevation

10.2.6 Sight distances

10.2.7 Gradient

10.2.8 Use of Nepal Road Standard and subsequent revision in road design



## 12.2 Site Management

### 12.2.1 Preparation of site plan

### 12.2.2 Organizing labor

### 12.2.3 Measures to improve labor efficiency

### 12.2.4 Accident prevention

## 12.3 Procurement and Contract Procedure

### 12.3.1 Contracts and its types

### 12.3.2 Departmental works and day-work

### 12.3.3 Preparation of tender document

### 12.3.4 Tender procedure

### 12.3.5 Contract agreement

### 12.3.6 Conditions of contract

### 12.3.7 Construction supervision

## 12.4 Accounts

### 12.4.1 Administrative approval and technical sanction

### 12.4.2 Familiarity with standard account keeping formats used in governmental organizations

### 12.4.3 Muster roll

### 12.4.4 Completion report

## 12.5 Planning and Control

### 12.5.1 Construction schedule

### 12.5.2 Equipment and materials schedule

### 12.5.3 Construction stages and operations

### 12.5.4 Bar chart

## (ख) कम्प्यूटर सम्बन्धी

### 1. Computer fundamental

### 2. Operating System

### 3. Word processing

### 4. Electronic spreadsheet

### 5. Database management system

### 6. Presentation system

### 10.3 Drainage System

10.3.1 Importance of drainage system and requirements of a good drainage system

10.4 Road Pavement: Pavement structure and its components: subgrade, sub-base, base and surface courses

### 10.5 Road Machineries

10.5.1 Earth moving and compacting machines

### 10.6 Road Construction Technology

10.7 Bridge: T-beam bridge and Timber bridges

10.8 Road Maintenance and Repair: Type of maintenance works

10.9 Tracks and Trails

10.10 **Airport Engineering:** Planning and layout of Heliports; Terminal Building and

Control Tower; Drainage System for Airports

## **11. Estimating and Costing**

### 11.1 General

11.1.1 Main items of work

11.1.2 Units of measurement and payment of various items of work and material

11.1.3 Standard estimate formats of government offices

### 11.2 Rate Analysis

11.2.1 Basic general knowledge on the use of rate analysis norms prepared by Ministry of Works and Transport and the district rates prescribed by district development committee

### 11.3 Specifications

11.3.1 Interpretation of specifications

### 11.4 Valuation

11.4.1 Methods of valuation

11.4.2 Basic general knowledge of standard formats used by commercial banks and NIDC for valuation

## **12. Construction Management**

### 12.1 Organization

12.1.1 Need for organization

12.1.2 Responsibilities of a civil Sub-engineer

12.1.3 Relation between Owner, Contractor and Engineer



(क) सेवा सम्बन्धी

खण्ड-१:- प्रशासनिक कार्य सम्बन्धी

१. रोजगारीको हकसम्बन्धी ऐन, २०७५ र रोजगारीको हकसम्बन्धी नियमावली, २०७५,
२. प्रधानमन्त्री रोजगार कार्यक्रम संचालन निर्देशिका, २०७५, कामका लागि पारिश्रमिकमा आधारित सामूदायिक आयोजना संचालन तथा व्यवस्थापन कार्यविधि, २०७६ र युवा रोजगारीका लागि रूपान्तरण पहल आयोजना (संचालन तथा व्यवस्थापन) कार्यविधि, २०७६,
३. कामका लागि पारिश्रमिक (Cash for Work) को अवधारणा,
४. स्थानीय तहको बजेट तर्जुमा प्रकृया, खर्च व्यवस्थापन र लेखा परीक्षण तथा गुनासो व्यवस्थापन,
५. सामाजिक परिचालन, सार्वजनिक सुनुवाई, सामाजिक लेखापरीक्षण तथा गुनासो व्यवस्थापन, र
६. आचरण तथा अनुशासन र सुशासन।

खण्ड-२:- प्राविधिक कार्य सम्बन्धी

- स्थानीय सेवाको इन्जिनियरिङ सेवा, सिभिल समूह पाँचौ तह सब-इन्जिनियर पदको लोकसेवा आयोगले निर्धारण गरेको देहाय बमोजिमको पाठ्यक्रमका विषयवस्तुहरु:

**1. Surveying**

1.1 General

1.1.1 Principle and types of surveying

1.1.2 Units, scales and maps

1.1.3 Field books and Level books

1.2 Levelling

1.2.1 Principles and methods of levelling

1.2.2 Levelling instruments and accessories

1.3 Plane Tabling

1.3.1 Equipments required

1.3.2 Methods of plane tabling

1.3.3 Two and three point problems



#### 1.4 Theodolite and Traverse surveying

1.4.1 Basic difference between different theodolites

1.4.2 Temporary adjustments of theodolites

1.4.3 Fundamental lines and desired relations

1.4.4 Tacheometry: stadia method

1.4.5 Trigonometrical levelling

1.4.6 Checks in closed traverse

#### 1.5 Contouring

1.5.1 Characteristics of contour lines

1.5.2 Method of locating contours

1.5.3 Contour plotting

#### 1.6 Setting Out: Small buildings and Simple curves

### 2. Construction Materials

#### 2.1 Stone

2.1.1 Formation and availability of stones in Nepal

2.1.2 Methods of laying and construction with various stones

2.2 Cement

2.2.1 Different cements: Ingredients, properties and manufacture

2.2.2 Storage and transport

2.2.3 Admixtures

#### 2.3 Clay and Clay Products

2.3.1 Brick: type, manufacture, laying, bonds

2.4 Paints and Varnishes: Type and selection; preparation techniques and use

2.5 Bitumen: Type, selection and use

### 3. Mechanics of Materials and Structures

#### 3.1 Mechanics of Materials

3.1.1 Internal effects of loading

3.1.2 Ultimate strength and working stress of materials

#### 3.2 Mechanics of Beams

3.2.1 Relation between shear force and bending moment

3.2.2 Shear and bending moment diagrams for statically determinate beams under various types of loading

#### 3.3 Simple Strut Theory