Field Survey Camp
EG 3201 CE

Year III
Semester: II

Total Hrs.: 80 Hrs. (8 days x 10 Hrs./day)

Course Introduction

Seven days field survey camp (closed camp) will provide exposure to the students to tackle with real field problems in civil engineering surveying.

After completion of the field works, students should have to prepare and submit a detailed report of survey camp including original data recorded in the field book, reference sketches, original plotted drawings and printed report. All the original data and drawings must be compiled and presented as final report during external examination (final viva-voce).

As far as possible, number of students in each group should not be more than 6 (six) and use modern surveying equipment such as Total Station, Theodolite, Auto level etc.

Course Objectives

- The main objectives of the survey camp are to consolidate and update students practical and theoretical knowledge in civil engineering surveying for planning, designing and execution of the works.
- Students get real field-based exposure to learn and apply different surveying methods, modern surveying instruments, computational practices and ways of presentation in their final reports.

Specific Objectives and Contents

Specific Objectives	Contents
• Understand reconnaissance survey, establishment of horizons control stations, pegging of major traverse and minor traverse stations. • Able to draw reference sketch of survey stations and index sketch of the area to be surveyed. • Understand the process of measurement of horizontal circle reading and vertical circle reading; • Be able to compute horizontal angles and horizontal distances. • Understand the computational procedures of X, Y and Z coordinates in the Gales Table.	**UNIT 1: Horizontal Control for Major Traverse**: (**2 Days)** A closed Major Traverse shall be performed at about 1.0 km periphery area with approximately **9 - 12** stations. Coordinates X and Y shall be controlled by Total Station and coordinate Z must be controlled by Auto Level. **Norms:** • One set of horizontal angles (o° set). • Traverse leg ratio 2:1 (Max: Min) • Linear measurement accuracy 1:5,000 for Total Station and 1:2,000 for Tape measurement. • Difference between FL and FR reading =180°±30" for Total Station and 180°±01' for Theodolite. • Angular Accuracy (LC√N) = (**45"** √**N**) for Total Station and (**1.5'**√**N**) for Theodolite. • Relative Accuracy Ratio = 1:5,000.
• Be able to perform Two Peg Test before Fly Levelling.	**UNIT 2: Horizontal and Vertical Control for Minor Traverse inside/outside the Major Traverse.** (**3**

Specific Objectives	Contents
• Collimation precision of Two Peg Test should be ≥1:10,000. • Understand Fly Levelling to Transfer RL from the permanent BM (or given BM) to SBM/TBM; • Know the process to be followed in Fly Levelling such as: • Observe three wire readings: distance between BS and FS should be within the tolerance of ± 1m (sight balance); mean BS and mean FS must be compatible with mid BS and mid FS (within a tolerance of ±3mm); • Turning Plate must be used in each Changing/Turning points; • Staff readings should be observed above 0.6m and below 2m for fly levelling.	**Days)** Detailed topographic survey shall be conducted within the perimeter of the semi built up area (about 700 m perimeter). Coordinates (X, Y, and Z) of these traverse stations including details shall be controlled by using Total Station and Auto level. Link traverse exercise is necessary. **Time Allocation:** • 1 Day for fly leveling and RL transfer from Bench Mark (BM) to Site Bench Mark (SBM) • 1 Days for detailing in minor traverse • 1 Day for computation and plotting of traverse etc. **Norms of Horizontal Control:** • One set of horizontal angles (o° set). • Traverse leg ratio 3:1 (Max: Min) • Linear measurement accuracy ≥ 1:5,000 for Total Station and ≥ 1:2,000 for direct Tape measurement. • Difference between FL and FR reading =180°±30" for Total Station and 180°±01' for Theodolite. • Angular Accuracy (LC√N) = (**1'0"**√**N**) for Total Station and (**2'0"**√**N**) for Theodolite. **Norms of Vertical Control:** • Collimation precision of Two Peg Test should be ≥1:10,000. • Circuit must be closed while transferring RL in Major and Minor Traverse stations. • Misclosure in all Vertical Control job should be within the tolerance of ± **24**√**K** mm, where K= Loop distance in KM.
• Determine the length of Bridge Axis by forming two Base Triangles (Well-conditioned triangles). • Perform Reciprocal Levelling to transfer RL from one bank of the river to another bank of the Bridge Axis point. • Perform the detailed topographic survey of bridge site. • Be able to plot the topographic map of Bridge Site Survey, L - Section	**UNIT 3: Bridge Site Survey (1.5 Days)** Detailed topographic survey of suitable bridge site area (150m*75m) shall be conducted by which Topographic map, L- section, X section etc. shall be prepared at standard scale. Use Theodolite to measure one set of horizontal angles in base triangles and in other control stations. Use Total Station for Detailing and Auto Level for Vertical control. **Norms:** • While choosing control stations of triangulation, Triangles should be in well condition. • One set of horizontal angles (0° set) in Base Triangles and in other Triangles. • Linear measurement accuracy ≥ 1:2,000 for Base line of in Base Triangles.

Specific Objectives	Contents
along the flow direction and X - Sections across the flow direction. • Plot Index contour by precise Arithmetic Mean method, then remaining contours either by Graphical method or by Estimation method.	• Difference between FL and FR reading =180°±01' for Theodolite. • Angular Accuracy (LC√N) =(**1.5'√N**) for Base Triangles and for other Triangles. • In Reciprocal Levelling, mean BS and mean FS must be compatible with mid BS and mid FS within a tolerance of ±3mm, and Misclosure = **± 24√K** mm, where K= Loop distance in KM (2 x length of Bridge Axis). • Perform Fly Levelling and close the circuit to transfer RL in all control stations.
• Understand the techniques of selection of Intersection Points (IP). • Measure clockwise angle horizontal circle reading (HCR) with respect to previous IP and forward IP to determine Deflection angle. • Understand to compute chainage along the center line of road alignment. • Be able to establish points in the simple circular curve like BC, MC, and EC. • Understand to take L – Section by Level; and X– Section by both Level instrument and by stepping method (staff and Tape). • Be able to draw Road corridor plan, L - section, X - section etc. shall be drawn at standard scale.	**UNIT 4: Road Alignment Survey (1.5 Days)** • Length of road alignment survey shall be at least 400m. • Road corridor plan, L - section, X - section etc. shall be drawn at standard scale including selection of grades and formation levels etc. **Norms** • As far as possible, select IP in such a way that deflection angles should be < 90° (desirable). • Gradient between adjacent Intersection Points (IP to IP) should be ≤ 12%. • Minimum Radius of the curve should be > 12m; choose the Radius of the curve in the multiple of 10m or 5m. • Successive curve must not be overlapped. • Observe only face left horizontal circle reading by Theodolite and measure deflection angles at each Intersection Point. • L - Section and X – Section should be taken at chainage points of 15m interval (multiple of 15 m) and at BC, MC and EC points. • In case of deflection angles being <3°, MC need not be established as External Distance become very small near to Vertex (IP points). • While transferring RL, TBM should be established after covering a tentative length of 500m, and Level Circuit must be closed; misclosure should be within the tolerance of **± 24√K** mm, where K= Loop distance in KM.

Evaluation System

Undergraduate Programs				
External Evaluation	**Marks**	**Internal Evaluation**	**Weightage**	**Marks**
External examination	40	Regular evaluation in the field throughout the 8 days, and viva-voce in the survey field. Field survey work, computation and plotting of major traverse, minor traverse be completed for internal viva-voce.	50%	60
Total External	40	Total Internal	50%	60

Full Marks: 100, Pass Marks: 50, Time: 3 Hrs]

Each student must secure at least 50% marks in both internal and external evaluation.

Attendance in Field Survey Camp:
Students should regularly attend and participate in the orientation class and field survey camp. Eighty percent class attendance is mandatory for the students. Below 80% attendance in the field survey camp will signify NOT QUALIFIED (NQ), may attend survey camp with junior batch after one year.

Transportation Engineering II
EG 3202 CE

Year: III **Total: 3 Hrs. /week**
Semester: II **Lecture: 3 Hrs./week**
Tutorial: Hr./week
Practical: Hrs./week
Lab: Hrs./week

Course Description:
This course is the continuation of Highway Engineering providing general background knowledge of road pavement, hill roads, road machineries, road construction technology and road maintenance.

Course Objectives:
After completion of this course students will be able to:
1. Differentiate between road pavement structures;
2. Provide concept of hill road focusing on difference aspect to be considered in design;
3. Know the different types of equipment's used in road construction along with the road construction methodology depending upon the type of road surface and
4. Be familiar with different types of failures that may occur in road pavement after its operation and probable causes of failure.

Course Contents:

Theory

Unit 1: **Road Pavement:** **[2 Hrs.]**
- 1.1 Definition, types, difference between flexible and rigid pavement
- 1.2 Different layers in pavement structure and their functions, sub-grade, sub-base, wearing course.

Unit 2: Hill Roads: **[7 Hrs.]**
- 2.1 Definition, importance of hill roads in Nepal
- 2.2 Design and construction problems in hill roads.
- 2.3 Special consideration of hill road geometric design: Temperature, Rainfall, Atmospheric pressure, Geological condition concept only
- 2.4 Typical cross sections of hill roads: drawing for concept only.
- 2.5 Special structures in hill roads like retaining walls, revetment walls, tow wall, slope protection works

Unit 3: Road Machineries: **[3 Hrs.]**
- 3.1 Methods of road construction (labor based, machine based)
- 3.2 Different types of tools, equipment and plants: Bulldozer & Scarper, Dragline, Clam shell, Power shovel, Hoe introduction.
- 3.3 Different types of compacting equipment: Smooth wheel rollers, sheep foot rollers, pneumatic tyred, impact rammers, vibrators

Unit 4: Road Construction Technology: **[18 Hrs.]**
- 4.1 Introduction
- 4.2 Activities involved in road construction: involved works only
  - 4.2.1 Earthwork
  - 4.2.2 Drainage work
  - 4.2.3 Pavement work

4.2.4 Protection works
4.2.5 Miscellaneous works

4.3 Earthwork
4.3.1 Introduction
4.3.2 Purpose
4.3.3 Earthwork in embankment/excavation
4.3.4 Relation of optimum moisture content and maximum dry density
4.3.5 Field control of compaction and test required concept only.

4.4 Construction of earthen road: Introduction, materials required, equipment required, construction procedure

4.5 Construction of gravel roads: Introduction, materials required, equipment required, construction procedure

4.6 Construction of soil stabilized roads: Introduction to soil stabilization, types of soil stabilization, mechanical stabilization of soil (materials, equipment, construction procedure)

4.7 Constructions of Water Bound Macadam (WBM) roads: Introduction, materials required, equipment required, construction procedure

4.8 Construction of bituminous roads: Introduction, types of bituminous surfacing, interface treatment (prime coat, tack coat), seal coat, functions of each coat

4.9 Surface dressing: types (single, double), materials required, equipment required, construction procedure

4.10 Grouted macadam: types (full, semi), materials required, equipment required, construction procedure

Unit 5: Highway Maintenance and Repair: [9 Hrs.]

5.1 Introduction, causes of pavement failure

5.2 Types of maintenance activities: Routine, Periodic, Special, Emergency

5.3 Maintenance of earth roads, gravel roads, WBM roads

5.4 Maintenance of bituminous roads (pot hole, patch repair works, crack sealing, edge repairing, resurfacing)

5.5 Maintenance of drainage structures

5.6 Maintenance of miscellaneous road structures (shoulder, slope, retaining structures, road furniture)

Unit 6: Bridge: [6 Hrs.]

6.1 Introduction
6.1.1 Definition, Characteristics, choice of location
6.1.2 Classification based on span, length, loading, materials and structures

6.2 T beam bridge
6.2.1 Essential elements
6.2.2 Detail of superstructure and substructure

6.3 Suspension bridge
6.3.1 Introduction
6.3.2 Components and their function

References:

1. Dinesh Kumar Shrestha, Anil Marsani, Transportation Engineering volume 1, Jasni Publications, Mid Baneshwor, Kathmandu, Nepal
2. Partha Mani Parajuli, Course Manual on Transportation Engineering I, IoE, Pulchowk, Lalitpur, Nepal.

3. C E G Justo, S K Khanna, Highway Engineering, Khanna Publications, New Delhi, India.
4. S. K. Sharma, Principles, Practice and Design of Highway Engineering, S Chand and Company Ltd. New Delhi.
5. A training manual on trail bridges, RTU, Department of Civil Engineering, Institute of Engineering.

Evaluation Scheme

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Unit	Title	Hrs. (L)	Marks distribution
1	Road Pavement	2	04
2	Hill Roads	7	16
3	Road Machineries	3	04
4	Road Construction Technology	18	28
5	Highway Maintenance and Repair	6	12
6	Bridge	9	16
		45	80

Estimating and Costing III
EG 3203 CE

Year: III
Semester: II

Total: 6 Hrs. /week
Lecture: 3 Hrs./week
Tutorial: 3 Hr./week
Practical: Hrs./week
Lab: Hrs./week

Course Description:
This course focuses on familiarization of estimating and costing. It also deals with the specifications of sanitary, water supply and irrigation works.

Course Objectives:
After completion of this course students will be able to:
1. Understand the procedures methods of measuring and quantity of irrigation, water supply and sanitary suspension bridges and culvert and RCC T beam decking works;
2. Analyze rates for irrigation and suspension bridge works;
3. Provide the basic knowledge of specification for water supply and sanitary and irrigation works and
4. Prepare the estimating the cost of irrigation, culvert water supply and sanitary works.

Course Contents:

Theory

Unit 1: Estimating of Water Supply and Sanitary Works [15 Hrs.]
- 1.1. Water supply and sanitary works
- 1.2. Rural Water supply works
- 1.3. Slow Sand Filter
- 1.4. Rapid Sand Filter
- 1.5. Method of estimating tube well and accessories
- 1.6. Methods of estimating of sanitary works
- 1.7. Method of estimating internal plumbing and water supply works
- 1.8. Methods of estimating service connection between Municipal supply and consumer's pipe
- 1.9. Sewer Line
- 1.10. Surface drains

Unit 2: Estimating of Irrigation Works [14 Hrs.]
- 2.1 Aqueduct
- 2.2 Canal Fall
- 2.3 Canal Syphon
- 2.4 Canal Lining
- 2.5 Method of estimating of earthwork in canal
- 2.6 Culvert and RCC T-Beam decking
- 2.7 Slab Culvert
- 2.8 Hume Pipe syphon
- 2.9 Suspension Bridge

Unit 3: Analysis of Rate for Irrigation and Suspension Bridges: [10 Hrs.]
- 3.1 Factors affecting the cost of irrigation and suspension bridge works
- 3.2 Factors affecting the cost of suspension bridge works
- 3.3 Government procedure of preparing analysis or rate for irrigation works

3.4 Government procedure of preparing analysis or rate for Suspension bridge works- Implementation by Community/ User's Group, Implementation by Contractor through public tender
3.5 Estimate quantities of earthwork in channel
3.6 Estimate slab culvert/ pipe culvert
3.7 Estimate manholes
3.8 Estimate aqueduct

Unit 4: Specifications: [6 Hrs.]

4.1 WC commode cistern
4.2 WC pan with cistern
4.3 Wash basin
4.4 G.I Pipe, PPR pipe, CPVC pipes and fittings
4.5 HDPE pipe and fittings
4.6 UPVC pipe and fittings
4.7 Canal lining
4.8 Hume pipe

Tutorial [45 Hrs.]

Taking out detailed quantities and preparing estimate for the following:

1. Estimate internal plumbing and water supply work
2. Estimate service connection between municipal and consumer's pipe
3. Estimate tube well and accessories
4. Estimate earthwork in channel/canal
5. Estimate canal lining
6. Estimate sewer line, manholes and surface drain
7. Estimate suspension/suspended bridge
8. Estimate slab culvert
9. Estimate RCC T-beam decking
10. Estimate rural water supply (Drawing prepared by the student in water supply)
11. Estimate aqueduct structure
12. Estimate canal fall structure
13. Estimate slow sand filter
14. Estimate rapid sand filter

References:

1. Amarjit Aggarwal "Estimating civil quantity surveying and valuation" katson publishing house, ludhiyana, 1985
2. G.S. Berdie "Test book of estimating and costing"
3. M. Chakraborti "Estimating, costing, specification and valuation in civil engineering"
4. B.N Dutta "Estimating and costing, specification and valuation"

Evaluation Scheme

Unit	Title	Hrs.	Marks Distribution
1	Methods of Estimating of Water Supply and Sanitary Works	15	24
2	Methods of Estimating of Irrigation Works	14	24
3	Analysis of Rates	10	20
4	Specifications	6	12
		45 Hrs.	**80**

Water Resources and Irrigation Engineering
EG 3204 CE

Year: III **Total: 8 Hrs. /week**
Semester: II **Lecture: 4 Hrs./week**
Tutorial: 2 Hrs./week
Practical: 2 Hrs./week
Lab: Hr./week

Course Description:
This course focuses the development and management of water resources and irrigation and its systems in general.

Course Objectives:
After completion of this course students will be able to:

1. Estimate irrigation water requirements;
2. Measure stream flow discharge;
3. Estimate monthly flows at intake;
4. Design canals based on soil type;
5. Identify suitable irrigation methods based on topography, crop and water source and
6. Explain the function, operation and maintenance of irrigation structures.
7. General knowledge of Micro Hydropower Plant (MHP)

Unit 1: Introduction to Water Resources and Irrigation Engineering. [3 Hrs.]

1.1 Definition, Need and objectives of irrigation
1.2 Advantages and disadvantages of irrigation
1.3 Sources of irrigation water and types of irrigation system
1.4 History and future scope of irrigation in Nepal

Unit 2: Crop Water and Irrigation Water Requirements: [8 Hrs.]

2.1 Types and season of crops
2.2 Base and crop periods
2.3 Duty, Delta and their relation
2.4 Commanded areas (gross, net and irrigable)
2.5 Soil moisture contents and irrigation intensity interval
2.6 Water requirement of different crops
2.7 Irrigation water requirement considering losses, land preparation and effective rainfall

Unit 3: Introduction to engineering hydrology [10 Hrs.]

3.1 Engineering hydrology and Hydrological cycle
3.2 Causes, form and types of precipitation
3.3 Hydrological losses: interception, depression storage, evaporation, evapotranspiration, infiltration
3.4 Occurrence and distribution of rainfall in Nepal (Surface and ground waters)
3.5 Catchment area and runoff generation (factors affecting runoff)
3.6 Rain gauges and stream gauges (Gauge types and data presentation)
3.7 Stream flow measurement by velocity area method (Floats and Current meters)
3.8 Rainfall-runoff relationship
3.9 Long term monthly flows at gauged and un-gauged locations
3.10 Hydrograph: Definition, types

3.11 Unit Hydrograph

Unit 4: Methods of Irrigation: [5 Hrs.]

4.1 Surface irrigation (Free flooding, Border strip, Check, Basin and Zigzag methods)
4.2 Subsurface irrigation
4.3 Sprinkler irrigation
4.4 Drip or Trickle irrigation

Unit 5: Diversion Head Works: [8 Hrs.]

5.1 Layout, components and their functions
5.2 Weir and Barrage systems
5.3 Silt control by under sluices at head works (still pond regulation and continuous flushing)
5.4 Silt excluder and sediment ejector
5.5 Head regulator

Unit 6: Canal Irrigation: [8 Hrs.]

6.1 Classification of canals
6.2 Components of canal system
6.3 Alignment of canals
6.4 Sediment transport in canal
6.5 Design of alluvial canals (Lacey's and Kennedy's theories)
6.6 Design of non-alluvial canals (Manning's and Chezy's Formulae)
6.7 Seepage of canals and lining
6.8 Canal standards

Unit 7: Irrigation Structures: [8 Hrs.]

7.1 Cross-drainages
7.2 Drops or Falls
7.3 Head and Cross regulators
7.4 Escapes
7.5 Outlets

Unit 8: Water Logging and Drainage: [5 Hrs.]

8.1 Causes, effects and preventive measures of water logging
8.2 Need and importance of drainage
8.3 Surface and subsurface drainage systems

Unit 9: Irrigation Management: [3 Hrs.]

9.1 Operation and maintenance of irrigation works
9.2 Institutional development of irrigation systems

Unit 10: Micro Hydropower Plant (MHP): [2 Hrs.]

10.1 Introduction, scope and applications of MHP
10.2 Advantages, disadvantages and applicability of MHP
10.3 Policy of MHP development in Nepal
10.4 General layout of basic components of MHP

Tutorials: **[30 Hrs.]**

1. Chapter 2: Computation of Duty-Delta relation, soil moisture content, irrigation interval and water requirement for crops **(6 Hrs.)**
2. Chapter 3: Estimation of Hydrological losses, Estimation of long-term monthly flows in river at intake, canal design discharge, analyze the unit hydrograph **(15 Hrs.)**
3. Chapter 6: Design of canals based on theory of Lacey, Kennedy, Chezy and Manning **(9 Hrs.)**

Practical **[30 Hrs.]**

1. Conduct Field visit at meteorological station and prepare report and present.
2. Stream flow measurement by velocity area method
3. Estimate irrigation water requirement by CROPWAT software

References:

1. Irrigation Engineering and Hydraulic Structures, S K Garg, Delhi, 1983
2. Irrigation Engineering, Gurcharan Singh
3. Fundamentals of Irrigation Engineering, Bharat Singh, Nem Chand and Bros, Roorkee, 1983
4. Theory and design of irrigation structures, volume I and II, R S Varshney, S C Gupta and R L Gupta, Nem Chand and Bros., Roorkee, 1979
5. Engineering Hydrology by K. Subramanya, Tata-McGraw Hill Publishing Co., New Delhi.
6. Engineering Hydrology by B. L. Cupta, Standard Publishers and Distributors, New Delhi.
7. Engineering Hydrologu by Dr. KN Dulal and Sanjeeb Baral, APEX Educationla Academy, Putalisadak, Kathmandu.
8. Garg S K, "lrrigation Engineering and Hydraulic Structures", Khanna Publishers, New Delhi

Evaluation Scheme:

The question will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Unit	Title	Hrs. (L+T)	Marks Distribution
1	Introduction to Water Resources and Irrigation Engineering	3+0=3	4
2	Crop Water and Irrigation Water Requirements	8+6=14	12
3	Introduction to engineering hydrology	10+15=25	20
4	Methods of Irrigation	5+0=5	4
5	Diversion Head Works	8+0=8	8
6	Canal Irrigation	8+9=17	12
7	Irrigation Structures	8+0=8	8
8	Water Logging and Drainage	5+0=5	4
9	Irrigation Management	3+0=3	4
10	Micro Hydropower Plant (MHP)	2+0=2	4
	Total	**90 Hrs]**	**80**

Entrepreneurship Development
EG 3201 MG

Year: III **Total: 5 Hrs. /week**
Semester: II **Lecture: 3 Hrs./week**
Tutorial: Hr./week
Practical: 2 Hrs./week
Lab: Hrs./week

Course Description:
This course is designed to provide the knowledge and skills on formulating business plan and managing small business. The entire course deals with assessing, acquiring, and developing entrepreneurial attitude; skills and tools that are necessary to start and run a small enterprise.

Course Objectives:
After completion of this course students will be able to:
1. Understand the concept of business and entrepreneurship;
2. Explore entrepreneurial competencies;
3. Analyze business ideas and viability;
4. Learn to formulate business plan with its integral components and
5. Manage small business.

Course Contents:

Theory

Unit 1: Introduction to Business & Entrepreneurship: [9 Hrs.]
- 1.1 Overview of entrepreneur and entrepreneurship
- 1.2 Wage employment, self- employment and business
- 1.3 Synopsis of types and forms of enterprises
- 1.4 Attitudes, characteristics & skills required to be an entrepreneur
- 1.5 Myths about entrepreneurs
- 1.6 Overview of MSMEs (Micro, Small and Medium Enterprises) in Nepal

Unit 2: Exploring and Developing Entrepreneurial Competencies: [9 Hrs.]
- 2.1 Assessing individual entrepreneurial inclination
- 2.2 Assessment of decision-making attitudes
- 2.3 Risk taking behavior and risk minimization
- 2.4 Creativity and innovation in business
- 2.5 Enterprise management competencies

Unit 3: Business identification and Selection: [4 Hrs.]
- 3.1 Sources and method of finding business idea(s)
- 3.2 Selection of viable business ideas
- 3.3 Legal provisions for MSMEs in Nepal

Unit 4: Business plan Formulation: **[18 Hrs.]**

4.1 Needs and importance of business plan

4.2 Marketing plan
- Description of product or service
- Targeted market and customers
- Location of business establishment
- Estimation of market demand
- Competitors analysis
- Estimation of market share
- Measures for business promotion

4.3 Business operation plan
- Process of product or service creation
- Required fix assets
- Level of capacity utilization
- Depreciation & amortization
- Estimation office overhead and utilities

4.4 Organizational and human resource plan
- Legal status of business
- Management structure
- Required human resource and cost
- Roles and responsibility of staff

4.5 Financial plan
- Working capital estimation
- Pre-operating expenses
- Source of investment and financial costs
- Per unit cost of service or product
- Unit price and profit/loss estimation of first year

4.6 Business plan appraisal
- Return on investment
- Breakeven analysis
- Risk factors

Unit 5: Small Business Management: **[5 Hrs.]**

5.1 Concept of small business management

5.2 Market and marketing mix

5.3 Basic account keeping

Practical

Unit 1: Overview of Business & Entrepreneurship [2 Hrs.]

1. Collect business information through interaction with successful entrepreneur

Unit 2: Exploring and Developing Entrepreneurial Competencies [2 Hrs.]

- Generate innovative business ideas

Unit 3: Product or service Identification and Selection [2 Hrs.]

1. Analyze business ideas using SWOT method

Unit 4: Business Plan Formulation [22 Hrs.]

1. Prepare marketing plan
2. Prepare operation plan
3. Prepare organizational and human resource plan
4. Prepare financial plan
5. Appraise business plan
6. Prepare action plan for business startup

Unit 5: Small Business Management [2 Hrs.]

1. Prepare receipt and payment account
2. Perform costing and pricing of product and service

Project Work
EG 3205 CE

Year: III
Semester: II

Total: 10 Hrs. /week
Lecture: Hr./week
Tutorial: Hr./week
Practical: 10 Hrs./week
Lab: Hr./week

Course Description:
This course is designed to make students aware of using theoretical and practical application in integrated manner to their knowledge gained during whole course related to civil engineering. Topics will normally contain measurement, design, drawing, cost estimate of components. Reading assignments and lecture on report design and oral presentations techniques will be in beginning of session. Preparation of the report and an oral seminar will occur at the end of the session.

Course Objectives:
After completion of this course students will be able to:

1. Prepare design, drawing and cost estimate of residential/small office building projects;
2. Prepare design, drawing and cost estimate of small rural water supply projects and sanitary works and
3. Prepare drawings and cost estimate of small roads and irrigation projects.

The overall assignment will be as follows:

A. Building:	5.0 Hrs./week
B. Sanitary and Water supply:	1.5 Hrs./week
C. Highway:	1.5 Hrs./week
D. Irrigation:	2.0 Hrs./week

Each part of the subjects will be evaluated as a continuous process.

Course Contents:
Unit 1: Building: **[75 Hrs.]**

1.1. Measure a plot of land for building layout.
1.2. Collect materials and labour rate for rate analysis.
1.3. Carryout architectural design and drawing of a 3 or 4 rooms and 2 to 4 storey residential/office building (site plan, floor plans, elevations, sections, flooring, roofing, staircase, finishes, fire place details).
1.4. Design/interpret structural components (foundation, wall, column, beams, ties, floors, and roof trusses) including seismic details drawings.
1.5. Prepare design and drawing of internal plumbing details (bathroom, hot and cold-water supply system, waste water and rain water systems).
1.6. Rain water (rain water harvesting, ground water recharge) and ground water treatment details for domestic use.
1.7. Study drawing of electrical system (power, light layout) and telephone network system.
1.8. Rate analysis and detailed cost estimate.
1.9. Prepare drawings both manually and using CADD software.

Unit 2: Sanitary and Water Supply: **[22 Hrs.]**

2.1. Prepare/observe external drainage system, sewer pipe layout, septic tank, soak pit design and drawings.
2.2. Prepare design and drawings of a rural water supply scheme (gravity flow).
2.3. Prepare bill of quantities and cost estimate.

Unit 3: Highway: **[23 Hrs.]**

3.1. Study of contour map.
3.2. Draw layout of road alignment, profile, cross-section with the help of given data/topographic map.
3.3. Design horizontal and vertical curve.
3.4. Provide typical retraining structures, drains and culverts.
3.5. Prepare bill of quantities and cost estimate.

Unit 4: Irrigation: **[30 Hrs.]**

4.1. Draw layout, profile and cross-section of small hill irrigation project with the help of given data/topographic map.
4.2. Draw typical head works structure (weir, trash-rack), aqueduct, fall, Siphon, lined canal sections etc.
4.3. Prepare bill of quantities and cost estimate.

Evaluation Scheme:

S. No.	Subjects/Topics	Marks distribution %	Internal %	Final %
1	Building	50	30	20
2	Sanitary and Water Supply	15	9	6
3	Highway	15	9	6
4	Irrigation	20	8	12
Total		**100**	**60**	**40**

References:

1. Course notes provided by the teachers/department.
2. Sample drawings of different municipality office, Nepal Government Projects.
3. Building bye-laws.
4. Building Construction Hand Book by Roy Chudley and Roger Greeno.
5. Nepal National Building Codes.
6. Village water systems- A technical journal (Nepal and Bhutan)
7. Estimating and Costing by B. N. Dutta.
8. Text books of related courses.
9. Government norms of rate analysis.

Trail Bridge
EG 3206 CE
(Elective)

Year: III
Semester: II

Total: 3 Hrs. /week
Lecture: 3 Hr./week
Tutorial: Hr./week
Practical: 3 Hrs./week
Lab: Hr./week

Course Description:
The course provides fundamental theoretical background for survey, design, cost estimates, construction and maintenance of trail bridges. The course focuses on survey, design and construction of Trail Bridges.

Course Objectives:
After completion of this course students will be able to:
1. Identify components of trail bridges;
2. Select appropriate bridge site and survey;
3. Perform design of a trail bridge;
4. Prepare standard drawings and quantity estimate;
5. Construct/supervise a trail bridge and
6. Explain trail bridge maintenance and site investigation works.

Course Contents:

Unit 1: Introduction **[2 Hrs.]**
- 1.1 Trail bridge in Nepal
- 1.2 Classification and standards of trail bridges
- 1.3 Trail bridge components

Unit 2: Bridge Site Selection and Survey **[7 Hrs.]**
- 2.1 Collection of essential data
- 2.2 Socio-economic survey
- 2.3 Bridge site selection
- 2.4 Topographic study and engineering survey

Unit 3: Design of Trail Bridges **[18 Hrs.]**
- 3.1 Basic design concept and design procedure
- 3.2 Cable
  - 3.2.1 Introduction to cable and its specification
  - 3.2.2 Cable geometry and its analytical presentation
  - 3.2.3 Cable design
- 3.3 Design of cable anchorages
- 3.4 Standard tower selection
- 3.5 Design of walkway, suspenders/hangers

Unit 4: Bridge Standard Drawings **[4 Hrs.]**
- 4.1 Construction drawings
- 4.2 Steel parts drawings

Unit 5: Estimating and Costing **[3 Hrs.]**
- 5.1. Quantity calculation of different bridge components

5.2. Rate analysis and Costing of different bridge components

Unit 6: Construction of Trail Bridges **[9 Hrs.]**

6.1 Construction planning
6.2 Setting out of the bridge
6.3 Excavation works
6.4 Cement works
6.5 Transportation, handling and hoisting of cable
6.6 Fabrication / erection / construction of bridges

Unit 7: Bridge Maintenance **[2 Hrs.]**

7.1. Introduction
7.2. Classification
7.3. Bridge condition investigation

References:

1. **Trail Suspension Bridges** (Course Manual), SBD, DOR & IOE.
2. **Short-span Trail Bridge Standard**, Technical Handbook, Trail Bridge Section, GoN.
3. **Survey, Design and Construction of Trail Suspension Bridges for Remote Areas**
   Volume A: **Design**, F. Grob, J. Krähenbühl, A. Wagner.
   Volume B: **Survey**, J. Krähenbühl, A. Wagner.
   Volume C: **Standard Design Drawings**, C. B. Basnet, J. Krähenbühl.
   Volume D: **Execution of Construction Works**, D. Panciotto.
   Volume E: **Costing and Contracting,** J. Krähenbühl.

Hill Road
EG 3206 CE
(Elective)

Year: III
Semester: II

Total: 3 Hrs. /week
Lecture: Hr./week
Tutorial: Hr./week
Practical: 3 Hrs./week
Lab: Hr./week

Course Description:
This course is aimed at providing general background knowledge of hill roads regarding route location process, geometric design, hairpin bends, and hill roads drainage.

Course Objectives:
After completion of this course students will be able to:

- Understand the concept of hill road alignment; consideration of different factors in choosing the alignments;
- Understand the principles of hill road geometric design, both vertical and horizontal together with drainage component of hill road;
- Know the construction methodology to be adopted in hill road along with pavement type and its maintenance and
- Sensitize special road side facilities to be provided in hill road and its safety implications and impact on environment.

Course Contents:

Theory

Unit 1: Introduction to Hill Roads: **[3 Hrs.]**

1.1 Definition and importance of hill roads in Nepal
1.2 Design and construction problems in hill roads
1.3 Special consideration of hill road geometric design

Unit 2: Hill Road Alignment: **[5 Hrs.]**

2.1 Introduction
2.2 Factors affecting hill road alignment
- Temperature
- Rainfall
- Atmospheric pressure
- Geological conditions

2.3 Survey methods
2.4 Hill road route location process

Unit 3: Geometric Design of Hill Roads: **[8 Hrs.]**

3.1 Introduction
3.2 Design speed (Introduction only)
3.3 Design of cross-sectional elements
- Road width
- Camber
- Super elevation
- Lateral and vertical clearance

3.4 Horizontal alignment (Introduction only)

- Superelevation
- Extrawidening
- Setback

3.5 Hair pin bends (symmetrical/unsymmetrical)
3.6 Typical cross sections of hill roads

Unit 4: Formation Works: [4 Hrs.]

4.1 Trace cut
4.2 Jungle clearance
4.3 Earthwork in excavation
4.4 Rock cutting, drilling, blasting, clearing
4.5 Earthwork in embankment
4.6 Tools required for manual method of road construction
4.7 Plants and equipment required for mechanized method of road construction

Unit 5: Pavement and Maintenance: [5 Hrs.]

5.1 Types of pavement
5.2 Factors governing pavement design
5.3 Pavement design methods
5.4 Introduction and necessity of maintenance
5.5 Component of maintenance activities

Unit 6: Drainage and Cross Drainage: [5 Hrs.]

6.1 Introduction
6.2 Hydrological study (empirical formula for runoff calculation)
6.3 Design of side drains
6.4 Intercepting catch water drains, chutes, cross drains, ford, causeways, subsurface drainage

Unit 7: Special Structures in Hill Roads: [4 Hrs.]

7.1 Slope protection structures
7.2 Classification of retaining walls (based on materials, structural scheme, location)
7.3 Parapet, railing and edge stones
7.4 River training structures

Unit 8: Road side Facilities, Safety and Environment: [7 Hrs.]

8.1 Introduction and importance of road side facilities
8.2 Types of road side facilities
8.3 Introduction to hill road safety
8.4 Introduction
8.5 Causes of accidents
8.6 Safety measures (engineering, enforcement, education)
8.7 Introduction to environment
8.8 Impact of highway projects on environment
8.9 Mitigation measures of adverse environmental impacts

Unit 9: Bio Engineering: [4 Hrs.]

9.1 Introduction
9.2 Function of bio engineering
9.3 Techniques of bio engineering

9.4 Characteristics of bio engineering
9.5 Suitable plants for bio engineering

Practical **[45 Hrs.]**

1. Perform design and drafting of hair pin bends (both symmetrical and unsymmetrical)
2. Perform drafting of hill road typical cross sections (cut and fill, benching, embankment with retaining walls, semi tunnel, semi bridge, platform)
3. Perform drafting of drainage facilities: Low level causeway, High level causeway, Pipe culvert, Slab culvert (Plan, Profile and Cross section)
4. Perform drafting of typical gravity retaining wall, gabion retaining wall (Cross section)
5. One day field visit

References:

1. Dinesh Kumar Shrestha, Anil Marsani, Transportation Engineering volume 1, Jasni Publications, Mid Baneshwor, Kathmandu, Nepal.
2. Partha Mani Parajuli, Course Manual on Transportation EngineeringI, IoE, Pulchowk, Lalitpur, Nepal.
3. C E G Justo, S K Khanna, Highway Engineering, Khanna Publications, New Delhi, India.
4. S. K. Sharma, Principles, Practice and Design of Highway Engineering, S Chand and Company Ltd. New Delhi.
5. Hill Road Manual, IRC SP 48: 1988, Indian Road Congress, New Delhi, India.

Evaluation Scheme

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Unit	Title	Hrs. (L)	Marks distribution
1	Introduction to Hill Roads	3	04
2	Hill Road Alignment	5	12
3	Geometric Design of Hill Roads	8	16
4	Formation Works	4	12
5	Pavement and Maintenance	5	12
6	Drainage and Cross Drainage	5	12
7	Special Structures in Hill Roads	4	08
8	Road side Facilities, Safety and Environment	7	12
9	Bio Engineering	4	08
	Total	**45**	**96**

Note:
Attempt any five questions out of six. All questions have (a) and (b) sub- questions.

Hill Irrigation Engineering
EG 3206 CE
(Elective)

Year: III
Semester: II

Total: 6 Hrs. /week
Lecture: 3 Hrs./week
Tutorial: Hr./week
Practical: 3 Hrs./week
Lab: Hrs./week

Course Description:
This course focuses on development and management of small canal irrigation and micro irrigation schemes in the hills of Nepal.

Course Objectives:
After completion of this course students will be able to:

1. Understand importance and scope of irrigation in the hills of Nepal;
2. Align safe and cost-effective canals in hilly areas;
3. Estimate monthly flows at intake;
4. Design canals based on soil type;
5. Know the specific irrigation structures suitable for hills;
6. Use sprinkler and drip irrigation methods in remote hills and
7. Operate and maintain hill irrigation systems.

Course Contents:

Theory

Unit 1: Introduction to hill irrigation: [5 Hrs.]

1.1 Physiographic regions and farming systems of Nepal
1.2 Characteristics of hill irrigation systems
1.3 Need, potentiality and types of irrigation development in the hills of Nepal

Unit 2: Environmental Aspects of Hill Irrigation: [5 HRS.]

2.1 Problems of floods, soil erosion and land slides
2.2 Mountain zone classification
2.3 Engineering and vegetative measures for hilly canals in different mountain zones

Unit 3: Planning and Implementation of Hill Irrigation: [4 HRS.]

3.1 Long term planning with farmer's participation
3.2 Request proposal for project assistance and screening
3.3 Stages of project study and data collection

Unit 4: Water Availability and Irrigation Requirements: [8 HRS.]

4.1 Flow assessment techniques based on data availability (MIP, WECS & HSC)
4.2 Extractable flow for irrigation
4.3 Consumptive use of selected cropping pattern
4.4 Operational water requirements
4.6 Percolation losses and irrigation efficiencies
4.7 Computation of irrigation water requirements

Unit 5: Canal Irrigation in Hills: [10 HRS.]

5.1 Canal intakes for hill irrigation: Suitable intakes and their locations; Design factors of bank intakes; Single orifice and bottom rack intakes
5.2 Sediment control for hill canals: Natural and artificial methods; Sediment control structures for hill canals; Gravel trap and settling basin

5.3 Canals and Distribution Systems for Hill Irrigation: Nomenclature, layout and alignment of hill canals; Seepage and lining of hill canals; Characteristics of distribution systems and Layout pattern appropriate to hill irrigation; Structural components of the distribution system; Flow division structures and Operation of Saacho

5.4 Escapes and Drop structures for Hill Canals: Need of escapes in hills; Suitable escapes for hills; Location of escapes in hills; Suitable drops in hills

5.5 Cross Drainage Structures for Hill Canals: Selection of suitable C/D structures in hills; Aqueducts, their advantages and disadvantages; Problems of aqueducts and prevention; Super passages, their advantages and disadvantages; Problems of super passages and prevention; Siphons and their disadvantages; Problems of siphons and prevention; Level crossings, their advantages and disadvantages; Inlets and Outlets

Unit 6: Sprinkler Irrigation: [5 HRS.]

6.1 Advantages and suitability of sprinkler for hill irrigation

6.2 Limitations and disadvantages of sprinkler irrigation

6.3 Types and components of sprinkler system

6.4 Design approach and selection of sprinklers

Unit 7: Drip or Trickle Irrigation: [5 HRS.]

7.1 Advantages and suitability of drip for hill irrigation

7.2 Limitations and disadvantages of drip irrigation

7.3 Types and components of drip system

7.4 Design approach and selection of drips

Unit 8: Gabion Structures for Remote Hill Areas: [3 HRS.]

8.1 Advantages of gabion construction

8.2 Design considerations for gabion structures

8.3 Characteristics of fill material

Practical [45 Hrs.]

1. Demonstration of sprinkler and drip irrigation
2. Assignment on estimation of monthly flows and floods at canal intake

References:

1. Hill Irrigation Engineering, Institute of Engineering, TU, Pulchowk Campus,Lalitpur.
2. Design Manuals for Irrigation Projects in Nepal, M.1 to M.13, Sir M MacDonald & Partners Ltd, PDSP, UNDP, World Bank, DOI, February 1990.
3. Simple Design of Hill Irrigation, P C Pokharel

Evaluation Scheme:

The question will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Unit	Title	Hrs. (L+T)	Marks Distribution
1	Introduction to hill irrigation	5	8
2	Environmental Aspects of Hill Irrigation	5	8
3	Planning and Implementation of Hill Irrigation	4	8
4	Water Availability and Irrigation Requirements	8	16
5	Canal Irrigation in Hills	10	20
6	Sprinkler Irrigation	5	8
7	Drip or Trickle Irrigation	5	8
8	Gabion Structures for Remote Hill Areas	3	4
	Total	**45**	**80**

Gravity Flow Water Supply System
EG 3206 CE
(Elective)

Year: III
Semester: II

Total: 6 Hrs. /week
Lecture: 3 Hrs./week
Tutorial: Hr./week
Practical: 3 Hrs./week
Lab:Hrs./week

Course Description:
This course is designed to provide the concepts and principles, and functions of the various components of gravity flow water supply system, water sources and their selection, determination of water demand, intake construction, design and construction of water mains and distribution systems. The practical work is expected to give students an in-depth knowledge of the gravity flow water supply systems.

Course Objectives:
After completion of this course students will be able to:

1. Explain the various types of gravity flow water supply system;
2. Describe the components of gravity flow water supply system;
3. Estimate the yield of various water sources;
4. Make selection of appropriate sources and
5. Carry out the feasibility survey for gravity water supply system.

Course Contents:

Theory

Unit 1. Gravity flow water supply system [4 Hrs.]

- 1.1 Definition
- 1.2 Types of gravity flow water supply system
  - 1.2.1 Closed systems
  - 1.2.2 Open systems
  - 1.2.3 Intermittent systems
  - 1.2.4 Combined system
- 1.3 Main components and their function
  - 1.3.1 Intake
  - 1.3.2 Collection Chamber for intakes
  - 1.3.3 Break Pressure Tank
  - 1.3.4 Distribution Chamber
  - 1.3.5 Reservoir Tank (RVT)- Concrete and ferrocement tank
  - 1.3.6 Sedimentation Tanks
  - 1.3.7 Pipeline
  - 1.3.8 Drain valve, Air relief valve.

Unit 2. Engineering Survey: [6 HRS.]

- 2.1 Types of survey- Feasibility, Detailed survey by using abney level
- 2.2 Source Measurement
  - 2.2.1 Wrist (Stop) watch-Bucket method
  - 2.2.2 Weir (V-Notch) method
  - 2.2.3 Velocity Area method
- 2.3 Safe Yield
- 2.4 Population Survey
- 2.5 Determination of material, transportation and labor availability and rates

Unit 3. Water demand **[4 HRS.]**

- 3.1 Design Period
- 3.2 Annual population growth rate
- 3.3 Water Demand
  - 3.3.1 Domestic demand
  - 3.3.2 Livestock demand
  - 3.3.7 Loss and wastage
  - 3.3.8 Total water demand
  - 3.3.3 Per capita demand
- 3.4 Peak period/Peak factor
- 3.5 Tap stand Flow requirement.

Unit 4. Pipeline Design: **[12 HRS.]**

- 4.1 Hydraulics Background
  - 4.1.1 Water Pressure
  - 4.1.2 Major Losses - Frictional Losses
  - 4.1.3 Minor Losses- bend, expansion, contraction
- 4.2 Pressure limits of pipes
- 4.3 Pipe Diameter
- 4.4 Velocity Limits
- 4.5 Freehand pipeline layout
- 4.6 Hydraulic Calculations
  - 4.6.1 Determination of the available frictional percent
  - 4.6.2 Selection of Pipe Size
  - 4.6.3 Example of Hydraulic design Calculation

Unit 5. Pipeline Construction: **[5 HRS.]**

- 5.1 Organizing Material and Labor
- 5.2 Laying of Pipeline
  - 5.2.1 Excavating Trenches
  - 5.2.2 Bedding Trenches
  - 5.2.3 Pipe Joining
  - 5.2.4 Thrust Blocking
  - 5.2.5 Backfilling Trenches
- 5.3 Break-Pressure Tank Construction

Unit 6. Intake Structures: **[4 HRS.]**

- 6.1 Spring Intakes
  - 6.1.1 Site selection
  - 6.1.2 Excavation of gravity fed springs
  - 6.1.3 Springs Catchment Structures
  - 6.1.4 Collection Chamber and Valve Box
- 6.2 Stream Intakes
  - 6.2.1 Site Selection
  - 6.2.2 Excavation
  - 6.2.3 Catchment Dam
  - 6.2.4 Spillway
  - 6.2.5 Valve Box, Collection Chamber and Fittings

Unit 7. Reservoir Tank (RVT): **[4 HRS.]**

- 7.1 Reservoir Tank Sizing
- 7.2 Reservoir Tank Layout

7.3 Location of Reservoir Tank
7.4 Material Requirements for RCC and ferrocement tanks

Unit 8. Tap stand: [4 Hrs.]

8.1 Necessity
8.2 Location of Tap stands
8.3 Tap stand Flow Rate
  8.3.1 Open Systems
  8.3.2 Intermittent Systems
8.4 Different types of tap stand
8.5 Fittings, Material and Labor Requirements

Unit 9. Sustainability of the System: [2 HRS.]

9.1 Awareness for maintenances of water supply system
9.2 User committee empowerment
9.3 Operation and maintenance
9.4 Continued training

Practical (with drawings) [45 HRS.]

1. Estimate design population and design discharge
2. Determine reservoir tank sizing
3. Compute tapstand flow rate
4. Compute pipe size
5. Observe rural water supply scheme and write a brief report and submit to concerned teacher

References:

1. Rural Gravity Flow Water Systems (Design Techniques and Standard Structures), UNICEF, Nepal, 1996.
2. Jordan, T. J., Handbook of Gravity Flow Water Systems, UNICEF, 1990.
3. Guidelines for Gravity Water Supply System (Survey, Design and Estimate), Rural Water
   Supply and Sanitation Fund Development Board (RWSSFDB).

Evaluation Scheme

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Unit	Title	Hrs. (L)	Marks Distribution
1	Gravity flow water supply system	4	8
2	Engineering Survey	6	8
3	Design Period, Per Capita Water Demand and Total Water Requirement	4	8
4	Pipeline Design	12	20
5	Pipeline Construction	5	8
6	Intake Structure	4	8
7	Reservoir Tank	4	8
8	Tap Stand	4	8
9	Sustainability of the System	2	4
	Total	**45**	**80**

*There may be minor variation in marks distribution.
The questions setting should be in the multiplication of 4

Micro Hydro Power Engineering
EG 3206 CE
(Elective)

Year: III **Total: 6 Hrs. /week**
Semester: II **Lecture: 3 Hrs./week**
Tutorial: Hr./week
Practical: 3 Hrs./week
Lab: Hrs./week

Course Description:
This course is aimed at providing general background knowledge of micro-hydropower projects, assessing hydro-potential, load demand and supply, its components, functions and design of main features.

Course Objectives:
After completion of this course, students will be able to:
1. Understand the concept of micro-hydropower;
2. Be familiar with the its components and functions and;
3. Understand the principles of sizing and design

Course Contents:

Theory

Unit 1: Introduction **[2 Hrs].]**
- 1.1 Introduction and working principle
- 1.2 History of MHP in Nepal
- 1.3 Multipurpose use of MHP
- 1.4 Site selection for MHP

Unit 2: Hydrology **[6 Hrs].]**
- 2.1 Introduction and definitions
- 2.2 Guidelines and standards
- 2.3 Discharge measurement
- 2.4 Hydrology and Nepali MHP
- 2.5 Hydrological data
- 2.6 Medium Irrigation Project (MIP) Method
- 2.7 WECS/DHM (HYDEST) Method
- 2.8 Flood flows

Unit 3: Head works **[4 Hrs].]**
- 3.1 Introduction and definitions
- 3.2 Guidelines and standards
- 3.3 Functions of weir, intake, track rack and spillway
- 3.4 Design criteria of weir and intake
- 3.5 Detail drawing of head works

Unit 4: Headrace/Tailrace **[4 Hrs].]**
- 4.1 Introduction and definitions
- 4.2 Functions and components of headrace canal
- 4.3 Guidelines and standards
- 4.4 Design of canal and pipe

4.5 Detail drawings of headrace/tailrace

Unit 5: Settling Basins **[5 Hrs].]**

5.1 Introduction and definitions
5.2 Functions and components of settling basins
5.3 Guidelines and Standards
5.4 Settling basin theory
5.5 Design criteria of gravel trap, settling basin and forebay
5.6 Detail drawings of settling basin

Unit 6: Support System **[4 Hrs].]**

6.1 Introduction and function of support system
6.2 Design criteria of anchor block,
6.3 Design criteria of support pier
6.4 Design criteria of machine foundation

Unit 7: Penstock and Power Calculations **[4 Hrs].]**

7.1 Introduction and definitions
7.2 Guidelines and standards
7.3 Detail drawings of penstock pipe and alignment

Unit 8: Turbine Selections **[4 Hrs].]**

8.1 Introduction and definitions
8.2 Guidelines and standards
8.3 Detail drawing of turbine

Unit 9: Electrical Equipment Selections **[4 Hrs].]**

9.1 Introduction and definitions
9.2 Guidelines and standards
9.3 Selection of generator size and type
9.4 Sizing and RPM of synchronous and induction generator
9.5 Detail drawings of electrical component (line diagram)

Unit 10: Transmission and Distribution **[3 Hrs].]**

10.1 Introduction and definitions
10.2 Guidelines and standards
10.3 Design criteria of transmission and distribution
10.4 Detail drawings of transmission and distribution

Unit 11: Loads and Benefits **[2 Hrs].]**

11.1 Introduction and Definitions
11.2 Guidelines and Standards
11.3 Calculation of load and benefits

Unit 12: Operation and Maintenance (O&M) **[3 Hrs].]**

12.1 O&M of civil structures
12.2 O&M of mechanical equipment
12.3 O&M of electrical equipment

Practical: **[45 Hrs.]**

Perform the design and draw followings:

1. Appropriate sizing of plant
2. Balancing energy demand and supply
3. Measurement of head and flow
4. Calculation of mean monthly flow and design flow
5. Sizing of orifice, spillway, headrace canal, pipes etc.
6. Desander and forebay tank
7. Sizing of turbines, generators, conductors

References

1. Allen R. Inversin (1986), Micro-Hydropower Sourcebook, A Practical Guide to Design and
2. Implementation in Developing Countries, NRECA International Foundation, 1800 Massachusetts Avenue N. W., Washington, DC 20036.
3. Adam Harvey (1993), Micro-Hydro Design Manual, A guide to small-scale water power schemes, Intermediate Technology Publications, ISBN 1 85339 103 4.
4. BPC Hydro consult, Intermediate Technology Development Group (ITDG), Kathmandu, Nepal (2002), Civil Works Guidelines for Micro-Hydropower in Nepal.
5. GTZ/Department of Energy Development, Energy Division, Papua New Guinea, Micro Hydropower Training Modules (1994), Modules 1-7, 10, 13, 14 & 18B.
6. European Small Hydropower Association (1998), Layman's Guidebook on How to Develop a Small Hydro Site
7. AEPC, Micro-Hydro Detail Feasibility Study Guideline
8. AEPC, Micro-Hydro Reference Standard
9. AEPC/NMHDA (2013), Micro/Mini-Hydropower Survey & Design Tools

Evaluation Scheme

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Chapter	Title	Hrs.	Mark distribution*
1	Introduction	2	4
2	Hydrology	6	10
3	Head works	4	8
4	Headrace/Tailrace	4	10
5	Settling Basins	5	10
6	Support System	4	6
7	Penstock and Power Calculations	4	8
8	Turbine Selections	4	6
9	Electrical Equipment Selections	4	6
10	Transmission and Distribution	3	4
11	Loads and Benefits	2	4
12	Operation and Maintenance (O&M)	3	4

* There may be minor deviation in marks distribution.

डिप्लोमा इन सिमिल इन्जिनियरिङ्ग कार्यक्रमको पाठ्यक्रम परिमार्जनमा खटिएका बिज्ञ सदस्यहरु

- प्रो. डा. बिश्वनाथ खनाल, बिषय बिज्ञ, IOE पुल्चोक, ललितपुर ।
- श्री शशि शाहा, बिषय बिज्ञ, पुनः निर्माण प्राधिकरण, काठमाण्डौं ।
- श्री खुशिराम अधिकारी, बिषय बिज्ञ, BSET, काठमाण्डौं ।
- श्री कुशल काफ्ले, बिषय बिज्ञ, Acmi Engineering College,, काठमाण्डौं ।
- श्री राजेन्द्र बहादुर क्षेत्री, बिषय बिज्ञ, IOE थापाथली काठमाण्डौ ।
- श्री गोर्कण बहादुर मोत्रा, बिषय बिज्ञ, IOE पुल्चोक, ललितपुर ।
- श्री भरत मण्डल, बिषय बिज्ञ, HOD, IoE, पुल्चोक, ललितपुर ।
- श्री कृष्ण प्रसाद गौतम, बिषय बिज्ञ, काठमाण्डौ ।
- श्री शुसिल कुमार श्रेष्ठ, बिषय बिज्ञ, शंकरापुर पोलिटेक्नीक इन्ष्टिच्युट, साँखु, काठमाण्डौं ।
- श्री दिपक भट्ट, बिषय बिज्ञ, BSET, काठमाण्डौं ।
- श्री कृष्ण अधिकारी, बिषय बिज्ञ, काठमाण्डौं ।
- श्री गुणानन्द झा, बिषय बिज्ञ, प्राविधिक शिक्षा तथा व्यावसायिक तालिम परिषद्, भक्तपुर ।
- श्री दिपक श्रेष्ठ, बिषय बिज्ञ, Freelancer, नेशनल कलेज, काठमाण्डौं ।
- श्री दिपक भट्ट, बिषय बिज्ञ, BSET, काठमाण्डौं ।
- श्री मोती श्रेष्ठ बिषय बिज्ञ, Vally Engineering College, काठमाण्डौ ।