

**Sixth Semester****Subjects:**

- |   |            |  |
|---|------------|--|
| 1 | EG 3201 CE | Field Survey Camp                          |
| 2 | EG 3202 CE | Transportation Engineering II              |
| 3 | EG 3203 CE | Estimating and Costing III                 |
| 4 | EG 3204 CE | Water Resources and Irrigation Engineering |
| 5 | EG 3201MG  | Entrepreneurship Development               |
| 5 | EG 3205 CE | Project Work                               |
| 6 | EG 3206 CE | Elective (One of the followings)           |
|   |            | A: Trail Bridge                            |
|   |            | B: Hill Road                               |
|   |            | C: Hill Irrigation Engineering             |
|   |            | D: Gravity Flow Water Supply System        |
|   |            | E: Micro Hydro Power Engineering           |

**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
<ul style="list-style-type: none"><li>• Understand reconnaissance survey, establishment of horizons control stations, pegging of major traverse and minor traverse stations.</li><li>• Able to draw reference sketch of survey stations and index sketch of the area to be surveyed.</li><li>• Understand the process of measurement of horizontal circle reading and vertical circle reading;</li><li>• Be able to compute horizontal angles and horizontal distances.</li><li>• Understand the computational procedures of X, Y and Z coordinates in the Gales Table.</li></ul>	<p><b>UNIT 1: Horizontal Control for Major Traverse: (2 Days)</b></p> <p>A closed Major Traverse shall be performed at about 1.0 km periphery area with approximately <b>9 - 12</b> stations. Coordinates X and Y shall be controlled by Total Station and coordinate Z must be controlled by Auto Level.</p> <p><b>Norms:</b></p> <ul style="list-style-type: none"><li>• One set of horizontal angles (<math>0^\circ</math> set).</li><li>• Traverse leg ratio 2:1 (Max: Min)</li><li>• Linear measurement accuracy 1:5,000 for Total Station and 1:2,000 for Tape measurement.</li><li>• Difference between FL and FR reading <math>= 180^\circ \pm 30''</math> for Total Station and <math>180^\circ \pm 01'</math> for Theodolite.</li><li>• Angular Accuracy <math>(LC\sqrt{N}) = (45'' \sqrt{N})</math> for Total Station and <math>(1.5' \sqrt{N})</math> for Theodolite.</li><li>• Relative Accuracy Ratio = 1:5,000.</li></ul>
<ul style="list-style-type: none"><li>• Be able to perform Two Peg Test before Fly Levelling.</li></ul>	<p><b>UNIT 2: Horizontal and Vertical Control for Minor Traverse inside/outside the Major Traverse. (3</b></p>

Specific Objectives	Contents
<ul style="list-style-type: none"> <li>• Collimation precision of Two Peg Test should be <math>\geq 1:10,000</math>.</li> <li>• Understand Fly Levelling to Transfer RL from the permanent BM (or given BM) to SBM/TBM;</li> <li>• Know the process to be followed in Fly Levelling such as:</li> <li>• Observe three wire readings: distance between BS and FS should be within the tolerance of <math>\pm 1\text{m}</math> (sight balance); mean BS and mean FS must be compatible with mid BS and mid FS (within a tolerance of <math>\pm 3\text{mm}</math>);</li> <li>• Turning Plate must be used in each Changing/Turning points;</li> <li>• Staff readings should be observed above 0.6m and below 2m for fly levelling.</li> </ul>	<p><b>Days)</b></p> <p>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.</p> <p><b>Time Allocation:</b></p> <ul style="list-style-type: none"> <li>• 1 Day for fly leveling and RL transfer from Bench Mark (BM) to Site Bench Mark (SBM)</li> <li>• 1 Days for detailing in minor traverse</li> <li>• 1 Day for computation and plotting of traverse etc.</li> </ul> <p><b>Norms of Horizontal Control:</b></p> <ul style="list-style-type: none"> <li>• One set of horizontal angles (<math>0^\circ</math> set).</li> <li>• Traverse leg ratio 3:1 (Max: Min)</li> <li>• Linear measurement accuracy <math>\geq 1:5,000</math> for Total Station and <math>\geq 1:2,000</math> for direct Tape measurement.</li> <li>• Difference between FL and FR reading <math>= 180^\circ \pm 30''</math> for Total Station and <math>180^\circ \pm 01'</math> for Theodolite.</li> <li>• Angular Accuracy (<math>LC\sqrt{N}</math>) = <math>(1'0'')\sqrt{N}</math> for Total Station and <math>(2'0'')\sqrt{N}</math> for Theodolite.</li> </ul> <p><b>Norms of Vertical Control:</b></p> <ul style="list-style-type: none"> <li>• Collimation precision of Two Peg Test should be <math>\geq 1:10,000</math>.</li> <li>• Circuit must be closed while transferring RL in Major and Minor Traverse stations.</li> <li>• Misclosure in all Vertical Control job should be within the tolerance of <math>\pm 24\sqrt{K}</math> mm, where K= Loop distance in KM.</li> </ul>
<ul style="list-style-type: none"> <li>• Determine the length of Bridge Axis by forming two Base Triangles (Well-conditioned triangles).</li> <li>• Perform Reciprocal Levelling to transfer RL from one bank of the river to another bank of the Bridge Axis point.</li> <li>• Perform the detailed topographic survey of bridge site.</li> <li>• Be able to plot the topographic map of Bridge Site Survey, L - Section</li> </ul>	<p><b>UNIT 3: Bridge Site Survey (1.5 Days)</b></p> <p>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.</p> <p>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.</p> <p><b>Norms:</b></p> <ul style="list-style-type: none"> <li>• While choosing control stations of triangulation, Triangles should be in well condition.</li> <li>• One set of horizontal angles (<math>0^\circ</math> set) in Base Triangles and in other Triangles.</li> <li>• Linear measurement accuracy <math>\geq 1:2,000</math> for Base line of in Base Triangles.</li> </ul>

Specific Objectives	Contents
<p>along the flow direction and X - Sections across the flow direction.</p> <ul style="list-style-type: none"> <li>Plot Index contour by precise Arithmetic Mean method, then remaining contours either by Graphical method or by Estimation method.</li> </ul>	<ul style="list-style-type: none"> <li>Difference between FL and FR reading = <math>180^\circ \pm 01'</math> for Theodolite.</li> <li>Angular Accuracy (<math>LC\sqrt{N}</math>) = <math>(1.5'\sqrt{N})</math> for Base Triangles and for other Triangles.</li> <li>In Reciprocal Levelling, mean BS and mean FS must be compatible with mid BS and mid FS within a tolerance of <math>\pm 3\text{mm}</math>, and Misclosure = <math>\pm 24\sqrt{K}</math> mm, where K= Loop distance in KM (2 x length of Bridge Axis).</li> <li>Perform Fly Levelling and close the circuit to transfer RL in all control stations.</li> </ul>
<ul style="list-style-type: none"> <li>Understand the techniques of selection of Intersection Points (IP).</li> <li>Measure clockwise angle horizontal circle reading (HCR) with respect to previous IP and forward IP to determine Deflection angle.</li> <li>Understand to compute chainage along the center line of road alignment.</li> <li>Be able to establish points in the simple circular curve like BC, MC, and EC.</li> <li>Understand to take L – Section by Level; and X– Section by both Level instrument and by stepping method (staff and Tape).</li> <li>Be able to draw Road corridor plan, L - section, X - section etc. shall be drawn at standard scale.</li> </ul>	<p><b>UNIT 4: Road Alignment Survey (1.5 Days)</b></p> <ul style="list-style-type: none"> <li>Length of road alignment survey shall be at least 400m.</li> <li>Road corridor plan, L - section, X - section etc. shall be drawn at standard scale including selection of grades and formation levels etc.</li> </ul> <p><b>Norms</b></p> <ul style="list-style-type: none"> <li>As far as possible, select IP in such a way that deflection angles should be <math>&lt; 90^\circ</math> (desirable).</li> <li>Gradient between adjacent Intersection Points (IP to IP) should be <math>\leq 12\%</math>.</li> <li>Minimum Radius of the curve should be <math>&gt; 12\text{m}</math>; choose the Radius of the curve in the multiple of 10m or 5m.</li> <li>Successive curve must not be overlapped.</li> <li>Observe only face left horizontal circle reading by Theodolite and measure deflection angles at each Intersection Point.</li> <li>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.</li> <li>In case of deflection angles being <math>&lt; 3^\circ</math>, MC need not be established as External Distance become very small near to Vertex (IP points).</li> <li>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 <math>\pm 24\sqrt{K}</math> mm, where K= Loop distance in KM.</li> </ul>

## 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**  
**Semester: II**

**Total: 3 Hrs. /week**  
**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**

- |                |   |                  |
|----------------|---|------------------|
| <b>Unit 1:</b> | <b>Road Pavement:</b>   | <b>[2 Hrs.]</b>  |
| 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.                                    |                  |
|                |   |                  |
| <b>Unit 2:</b> | <b>Hill Roads:</b>  | <b>[7 Hrs.]</b>  |
| 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                            |                  |
| <b>Unit 3:</b> | <b>Road Machineries:</b>  | <b>[3 Hrs.]</b>  |
| 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 tired, impact rammers, vibrators       |                  |
|                |   |                  |
| <b>Unit 4:</b> | <b>Road Construction Technology:</b>  | <b>[18 Hrs.]</b> |
| 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
		<b>45 Hrs.</b>	<b>80</b>

**Water Resources and Irrigation Engineering**  
**EG 3204 CE**

**Year: III**  
**Semester: II**

**Total: 8 Hrs. /week**  
**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. Gupta, Standard Publishers and Distributors, New Delhi.
7. Engineering Hydrology by Dr. KN Dulal and Sanjeeb Baral, APEX Educationla Academy, Putalisadak, Kathmandu.
8. Garg S K, "Irrigation 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
	<b>Total</b>	<b>90 Hrs]</b>	<b>80</b>

**Entrepreneurship Development**  
**EG 3201 MG**

**Year: III**  
**Semester: II**

**Total: 5 Hrs. /week**  
**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 retaining 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
<b>Total</b>		<b>100</b>	<b>60</b>	<b>40</b>

**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:**

- |  |                  |
|--|------------------|
| <b>Unit 1: Introduction</b>  | <b>[2 Hrs.]</b>  |
| <ul style="list-style-type: none"><li>1.1 Trail bridge in Nepal</li><li>1.2 Classification and standards of trail bridges</li><li>1.3 Trail bridge components</li></ul>  |                  |
| <b>Unit 2: Bridge Site Selection and Survey</b>  | <b>[7 Hrs.]</b>  |
| <ul style="list-style-type: none"><li>2.1 Collection of essential data</li><li>2.2 Socio-economic survey</li><li>2.3 Bridge site selection</li><li>2.4 Topographic study and engineering survey</li></ul>  |                  |
| <b>Unit 3: Design of Trail Bridges</b>   | <b>[18 Hrs.]</b> |
| <ul style="list-style-type: none"><li>3.1 Basic design concept and design procedure</li><li>3.2 Cable<ul style="list-style-type: none"><li>3.2.1 Introduction to cable and its specification</li><li>3.2.2 Cable geometry and its analytical presentation</li><li>3.2.3 Cable design</li></ul></li><li>3.3 Design of cable anchorages</li><li>3.4 Standard tower selection</li><li>3.5 Design of walkway, suspenders/hangers</li></ul> |                  |
| <b>Unit 4: Bridge Standard Drawings</b>  | <b>[4 Hrs.]</b>  |
| <ul style="list-style-type: none"><li>4.1 Construction drawings</li><li>4.2 Steel parts drawings</li></ul>   |                  |
| <b>Unit 5: Estimating and Costing</b>  | <b>[3 Hrs.]</b>  |
| <ul style="list-style-type: none"><li>5.1. Quantity calculation of different bridge components</li></ul>   |                  |

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.