# CURRICULUM

# DIPLOMA
# Civil Engineering
**(Three-year program-semester system)**




Council for Technical Education and Vocational Training
**Curriculum Development and Equivalence Division**
**Sanothimi, Bhaktapur**
**2013**
**First Revision 2021**

# Table of Contents


Introduction....1
Rational....1
Curriculum Title:....1
Aim....1
Objectives....1
Group Size....2
Entry Criteria....2
Duration....2
Medium of Instruction....2
Pattern of Attendance....2
Teachers and Students Ratio....2
Qualification of Teachers and Instructors....2
Instructional Media and Materials....3
Teaching Learning Methodologies....3
Mode of Education....3
Examination and Marking Scheme....3
Provision of Back Paper....4
Disciplinary and Ethical Requirements....4
Grading System....4
Certification and degree awards:....4
Career Opportunity....4
Subjects Codes....5
Provision of specialization:....5
Course Structure:....6
First Year....9
Second Year....10
Third Semester....11
- Engineering Mathematics III....12
- Surveying I....14
- Workshop Practice II....17
- Fluid Mechanics and Hydraulics....27
- Building Construction....30
- Engineering Materials....36

Fourth Semester....39
- Social Engineering....40
- Construction Drawing and CAD....43
- Surveying II....47
- Estimating and Costing I....50
- Mechanics of Structure....52
- Soil Mechanics and Foundation Engineering....55
- Water Supply Engineering....58

Third Year....63
Fifth Semester....64

Surveying III ..... 65
Estimating and Costing II ..... 68
Design of Reinforced Concrete (RC) Structures ..... 70
Transportation Engineering I ..... 74
Sanitary Engineering ..... 78
Construction Management ..... 82
Design of Steel and Timber Structures ..... 85
Sixth Semester ..... 88
Field Survey Camp ..... 89
Transportation Engineering II ..... 93
Estimating and Costing III ..... 96
Water Resources and Irrigation Engineering ..... 98
Entrepreneurship Development ..... 101
Project Work ..... 104
Trail Bridge ..... 106
Hill Road ..... 108
Hill Irrigation Engineering ..... 111
Gravity Flow Water Supply System ..... 113
Micro Hydro Power Engineering ..... 116
डिप्लोमा इन सिमिल इन्जिनियरिङ्ग कार्यक्रमको पाठ्यक्रम परिमार्जनमा खटिएका बिज्ञ सदस्यहरु ..... 119

## Introduction

Civil Engineering is one of the prominent and popular disciplines within engineering. The curriculum is designed for producing middle level technical workforce equipped with knowledge and skills related to the field of Civil Engineering to meet the demand of such workforce in the country to contribute in the national economic development of Nepal. The knowledge and skills incorporated in this curriculum will be helpful to deliver the individual needs as well national needs in the field of Civil Engineering. Many people in the developed countries, developing countries and under developed countries have given emphasis for the broader application of Civil Engineering. This field has been helping the world for the all-round physical infrastructure development and it has been creating wage and self-employment opportunities both in public and private sectors.

The Diploma in Civil Engineering programme extends over three years. Each year is divided into two semesters. There are six semesters in total within the period of three years.
The foundational subjects like Physics, Chemistry, and Mathematics are offered in diffusion model of curricular programme are applicable in the field of Civil Engineering. It also includes language subjects like Nepali and English applicable for the communication in the same area. The disciplinary subjects of Civil Engineering are offered in this programme are included in all semesters. This curricular programme also makes provision of project works as well as elective subjects in the specific areas of Civil Engineering. The curriculum structure and the subject wise content that reflect the details of this curriculum. In brief, this curriculum will guide to its implementers to produce competent and highly employable middle level technical workforces in the field of civil engineering.

The contents of each subjects prescribed in the curriculum are incorporated in the light of "must know and must do" principle. The contents of the curriculum are minutely described in micro level.

## Rational

Engineering is a progressive, constantly changing and a rapidly evolving industry, promising a wide range of opportunities. It has been revised to apply the newly evolved knowledge and technologies in the courses and make them more relevant. Most modern businesses and industry need people with specific skills and knowledge to support in the workplace. Such technologies are prioritized with change in workload in the revision. It needed to revise the curriculum to accumulate them according to the changing technology and link them with the world of work as well as higher studies.

## Curriculum Title:

Diploma in Civil Engineering

## Aim

The program aims to produce middle level technical personnel in the field of civil engineering with sound academic knowledge equipped with technical skills that can be applied in real life situation.

## Objectives

This curriculum has following objectives to:

- Prepare technicians who are capable of undertaking works in civil engineering field as Civil Engineering Technicians under Road, Irrigation, Water supply, Urban

Development and Building Construction and other civil infrastructures development related departments and sectors;
- Produce middle level competent technical workforce/human resources that could provide supervisory works of civil engineering;
- Prepare technical workforce who will demonstrate positive attitude and respect for the profession and socio-cultural values;
- Help in meeting the demand of required Civil Engineering Technicians for the public and private infrastructure development sector of Nepal;
- Prepare such technical workforce who will demonstrate positive attitude and respect to the profession and socio-cultural values.
- Create self-employment opportunities.

**Group Size**
The group size will be maximum of 48 (forty-eight) students in a batch.

**Entry Criteria**
- SLC Pass or SEE with minimum C grade in Compulsory Mathematics & Science and D+ in English.
- Pre-diploma in Civil Engineering with minimum 67.00%.
- Should pass entrance examination administered by CTEVT.

**Duration**
The total duration of this curricular program is three academic years (six semester). The program is based on semester system. Moreover, one semester consists of 19.5 academic weeks including evaluation period. Actual teaching learning Hrs. will be not less than 15 weeks in each semester.

**Medium of Instruction**
The medium of instruction will be in English and/or Nepali.

**Pattern of Attendance**
Minimum of 90% attendance in each subject is required to appear in the respective final examination.

**Teachers and Students Ratio**
The ratio between teachers and students must be:
- Overall ratio of teacher and student must be 1:12 (at the institution level)
- 1:48 for theory and tutorial classes
- 1:12 for practical/demonstration
- 1:6 for bench work
- 75 % of the technical teachers must be full timer

**Qualification of Teachers and Instructors**
- The program coordinator should be a master's degree holder in the related area.
- The disciplinary subject related teacher and demonstrators should be a bachelor’s degree holder in the related area.
- The foundational subject related teacher (refer to course code SH and MG) should be master’s degree holder in the related area.

**Instructional Media and Materials**

The following instructional media and materials are suggested for the effective instruction and demonstration.

- ***Printed Media Materials*** (Assignment sheets, Hand-outs, Information sheets, Individual training packets, Procedure sheets, Performance check lists, Textbooks etc.).
- ***Non-projected Media Materials*** (Display, Flip chart, Poster, Writing board etc.).
- ***Projected Media Materials*** (Opaque projections, multimedia, Slides etc.).
- ***Computer-Based Instructional Materials*** (Computer-based training, Interactive video etc.)

**Teaching Learning Methodologies**

The methods of teachings for this curricular program will be a combination of several approaches such as; lecture, illustrated talk, tutorial, group discussion, demonstration, simulation, guided practice, self-practice, fieldwork, block study, industrial practice, report writing, term paper presentation, heuristic and other independent learning exercises.

**Theory:** Lecture, discussion, assignment, interaction, seminar, group work.

**Practical:** Demonstration, observation, simulation, guided practice, self-practice, industrial practice and project work.

**Mode of Education**

There will be inductive and deductive mode of education.

**Examination and Marking Scheme**

**a. Internal assessment**

- There will be a transparent/fair evaluation system for each subject both in theory and practical exposure.
- Each subject will have internal assessment at regular intervals and students will get the feedback about it.
- Weightage of theory and practical marks are mentioned in course structure.
- Continuous assessment format will be developed and applied by the evaluators for evaluating student's performance in the subjects related to the practical experience.

**b. Final examination**

- Weightage of theory and practical marks are mentioned in course structure.
- Students must pass in all subjects both in theory and practical for certification. If a student becomes unable to succeed in any subject, s/he will appear in the re-examination administered by CTEVT.
- Students will be allowed to appear in the final examination only after completing the internal assessment requirements.

**c. Requirement for final practical examination**

- Professional of relevant subject instructor must evaluate final practical examinations.
- One evaluator in one setting can evaluate not more than 24 students.
- Practical examination should be administered in actual situation on relevant subject with the provision of at least one internal evaluator from the concerned or affiliating institute led by external evaluator nominated by CTEVT.
- Provision of re-examination will be as per CTEVT policy.

**d. Final practicum evaluation will be based on:**

- Institutional practicum attendance - 10%
- Logbook/Practicum book maintenance - 10%
- Spot performance (assigned task/practicum performance/identification/arrangement preparation/measurement) - 40%
- Viva voce:
  - Internal examiner - 20%
  - External examiner - 20%

**e. Pass marks:**

- The students must secure minimum 40% marks in theory and 50% marks in practical. Moreover, the students must secure minimum pass marks in the internal assessment and in the semester final examination of each subject to pass the subject.

**Provision of Back Paper**

There will be the provision of back paper but a student must pass all the subjects of all semester within six years from the enrollment date; however, there should be provision of chance exam for final semester students as per CTEVT rules.

**Disciplinary and Ethical Requirements**

- Intoxication, insubordination or rudeness to peers will result in immediate suspension followed by the review of the disciplinary review committee of the institute.
- Dishonesty in academic or practical activities will result in immediate suspension followed by administrative review, with possible expulsion.
- Illicit drug use, bearing arms in institute, threats or assaults to peers, faculty or staff will result in immediate suspension, followed by administrative review with possible expulsion.

**Grading System**

The following grading system will be adopted:

- Distinction: 80% and above
- First division: 65% to below 80%
- Second division: 50 % to below 65%
- Pass division: Pass marks to Below 50%

**Certification and degree awards:**

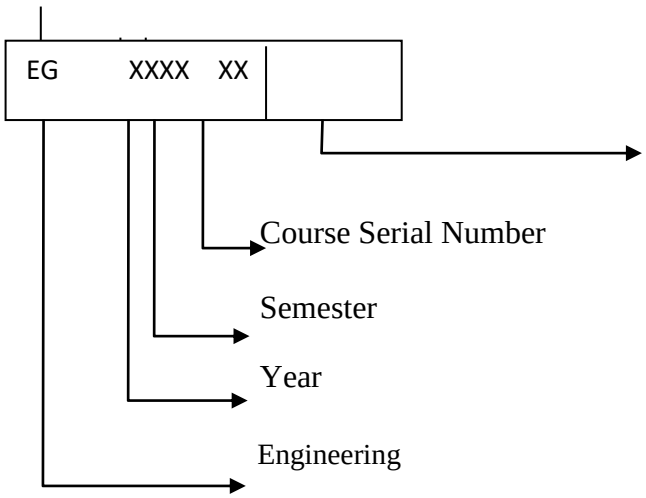
- Students who have passed all the components of all subjects of all 6 semester are considered to have successfully completed the program.
- Students who have successfully completed the program will be awarded with a degree of **"Diploma in Civil Engineering"**.

**Career Opportunity**

The graduates will be eligible for the position equivalent to Non-gazette 1st class/Level 5 (technical) as prescribed by the Public Service Commission of Nepal and other related agencies. The graduate will be eligible for registration with the related professional council in the grade as provisioned in the related Council Act (if any).

**Subjects Codes**

Each subject is coded with a unique number preceded and followed by certain letters as mentioned in following chart:




**Offering Departments:**

AR: Architecture

EE: Electrical Engineering

ME: Mechanical Engineering

EX: Electronics Engineering

CT: Computer Engineering

CE: Civil Engineering

SH: Science and Humanities

MG: Management

**Provision of specialization:**

There will be no provision of specialization but some subjects are offered here as the elective subjects; viz Trail Bridge, Hill Road, Hill Irrigation Engineering, Gravity Flow water Supply System and Micro Hydro Power Engineering.

## Course Structure:

**YEAR: I** **SEMESTER I**

| S.N. | Code No. | Subjects | Mode | | | | Total Hrs. | DISTRIBUTION OF MARKS | | | | | | Total Marks | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Theory | | | Practical | | | | |
| | | | L | T | P | Lab | | Assmt. Marks | Final Marks | Time Hrs. | Assmt. Marks * | Final Marks | Time Hrs. | | |
| 1 | EG 1101 SH | Applied Nepali | 4 | | | | 4 | 20 | 80 | 3 | | | | 100 | *Continuous assessment |
| 2 | EG 1102 SH | Applied English | 4 | | | | 4 | 20 | 80 | 3 | | | | 100 | |
| 3 | EG 1103 SH | Engineering Mathematics I | 4 | 2 | | | 6 | 20 | 80 | 3 | | | | 100 | |
| 4 | EG 1104 SH | Engineering Physics I | 4 | 2 | | 2 | 8 | 20 | 60 | 3 | 10 | 10 | 2 | 100 | |
| 5 | EG 1105 SH | Engineering Chemistry I | 4 | 2 | | 2 | 8 | 20 | 60 | 3 | 10 | 10 | 2 | 100 | |
| 6 | EG 1101 AR | Engineering Drawing, I | 1 | | 4 | | 5 | 0 | 0 | | 60 | 40 | 4 | 100 | |
| 7 | EG 1211 CT | Computer Application | 2 | | 2 | | 4 | 10 | 40 | 1.5 | 30 | 20 | 3 | 100 | |
| **TOTAL** | | | **23** | **6** | **6** | **4** | **39** | **110** | **400** | | **110** | **80** | | **700** | |

**YEAR: I** **SEMESTER II**

| S.N. | Code No. | Subjects | Mode | | | | Total Hrs. | DISTRIBUTION OF MARKS | | | | | | Total Marks | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Theory | | | Practical | | | | |
| | | | L | T | P | Lab | | Assmt. Marks | Final Marks | Time Hrs. | Assmt. Marks * | Final Marks | Time Hrs. | | |
| 1 | EG 1201 SH | Engineering Mathematics II | 4 | 2 | | | 6 | 20 | 80 | 3 | | | | 100 | *Continuous assessment |
| 2 | EG 1202 SH | Engineering Physics II | 4 | 2 | | 2 | 8 | 20 | 60 | 3 | 10 | 10 | 2 | 100 | |
| 3 | EG 1203 SH | Engineering Chemistry II | 4 | 2 | | 2 | 8 | 20 | 60 | 3 | 10 | 10 | 2 | 100 | |
| 4 | EG 1201 CE | Workshop Practice I | 2 | | 6 | | **8** | 0 | 0 | | 60 | 40 | 4 | 100 | |
| 5 | EG 1201 AR | Engineering Drawing II | 0 | | 4 | | 4 | 0 | 0 | | 60 | 40 | 4 | 100 | |
| 6 | EG 2102 CE | Applied Mechanics | 3 | 2 | | 2/2 | 6 | 20 | 60 | 3 | 20 | 0 | | 100 | |
| | | **TOTAL** | **17** | **8** | **10** | **5** | **40** | **80** | **260** | | **160** | **100** | | **600** | |

# Diploma in Civil Engineering
## Course Structure

**YEAR: II** **SEMESTER I**

| S.N. | Code No. | Subjects | Mode | | | | Total Hrs. | DISTRIBUTION OF MARKS | | | | | | Total Marks | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Theory | | | Practical | | | | |
| | | | L | T | P | Lab | | Assmt. Marks | Final Marks | Time Hrs. | Assmt. Marks* | Final Marks | Time Hrs. | | |
| 1 | EG 2101 SH | Engineering Mathematics III | 3 | 1 | | | 4 | 20 | 80 | 3 | | | | 100 | *Continuous assessment |
| 2 | EG 2101CE | Surveying I | 3 | | 4 | | 7 | 20 | 80 | 3 | 60 | 40 | 4 | 200 | |
| 3 | EG 2102 CE | Workshop Practice II | 3 | | 9 | | 12 | | | | 120 | 80 | 4 | 200 | |
| 4 | EG 2103 CE | Fluid Mechanics and Hydraulics | 3 | 1 | | 2/2 | 5 | 20 | 80 | 3 | 25 | | | 125 | |
| 5 | EG 2104 CE | Building Construction | 6 | 0 | | 2/2 | 7 | 20 | 80 | 3 | 25 | | | 125 | |
| 6 | EG 2105 CE | Engineering Materials | 4 | | | 2/2 | 5 | 20 | 80 | 3 | 25 | | | 125 | |
| **TOTAL** | | | **22** | **2** | **13** | **3** | **40** | | | | | | | **875** | |

**YEAR: II** **SEMESTER II**

| S.N. | Code No. | Subjects | Mode | | | | | DISTRIBUTION OF MARKS | | | | | | Total Marks | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Theory | | | Practical | | | | |
| | | | L | T | P | Lab | Total Hrs. | Assmt. Marks | Final Marks | Time Hrs. | Assmt. Marks* | Final Marks | Time Hrs. | | |
| 1 | EG 2201 SH | Social Engineering | 2 | | | | 2 | 10 | 40 | 1.5 | | | | 50 | *Continuous assessment |
| 2 | EG 2201 AR | Construction Drawing and CAD | 1 | | 4 | | 5 | | | | 60 | 40 | 4 | 100 | |
| 3 | EG 2201 CE | Surveying II | 3 | | 4 | | 7 | 20 | 80 | 3 | 60 | 40 | 4 | 200 | |
| 4 | EG 2202 CE | Estimating and Costing I | 3 | 3 | 1 | | 7 | 20 | 80 | 3 | 25 | | | 125 | |
| 5 | EG 2203 CE | Mechanics of Structure | 4 | 1 | | 2/2 | 6 | 20 | 80 | 3 | 25 | | | 125 | |
| 6 | EG 2204 CE | Soil Mechanics and Foundation Engineering | 4 | 2 | | 2/2 | 7 | 20 | 80 | 3 | 25 | | | 125 | |
| 7 | EG 2205 CE | Water Supply Engineering | 4 | 1 | | 2/2 | 6 | 20 | 80 | 3 | 25 | | | 125 | |
| **TOTAL** | | | **21** | **7** | **9** | **3** | **40** | **110** | **440** | | **220** | **80** | | **850** | |

# Diploma in Civil Engineering
# Course Structure

**YEAR: III** **SEMESTER I**

| S. N | Code No. | Subjects | Mode | | | | Total Hrs. | DISTRIBUTION OF MARKS | | | | | | Total Marks | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Theory | | | Practical | | | | |
| | | | L | T | P | Lab | | Assmt. Marks | Final Marks | Time Hrs. | Assmt. Marks* | Final Marks | Time Hrs. | | |
| 1 | EG 3101 CE | Surveying III | 3 | | 4 | | 7 | 20 | 80 | 3 | 60 | 40 | 4 | 200 | *Continuous assessment |
| 2 | EG 3102 CE | Estimating and Costing II | 3 | 3 | | | 6 | 20 | 80 | 3 | | | | 100 | |
| 3 | EG 3103 CE | Design of Reinforced Concrete (RC) Structure | 4 | 2 | 2 | | 8 | 20 | 80 | 3 | 30 | 20 | 3 | 150 | |
| 4 | EG 3104 CE | Transportation Engineering I | 3 | 1 | | 2/2 | 5 | 20 | 80 | 3 | 25 | | | 125 | |
| 5 | EG 3105 CE | Sanitary Engineering | 3 | 1 | | | 4 | 20 | 80 | 3 | | | | 100 | |
| 6 | EG 3106 CE | Construction Management | 5 | 1 | | | 6 | 20 | 80 | 3 | | | | 100 | |
| 7 | EG 3107 CE | Design of Steel and Timber Structure | 2 | 1 | 1 | | 4 | 10 | 40 | 1.5 | 25 | | | 75 | |
| **TOTAL** | | | **23** | **9** | **7** | **1** | **40** | **140** | **540** | | **125** | **70** | | **875** | |

**YEAR: III** **SEMESTER II**

| S. N | Code No. | Subjects | Mode | | | | Total Hrs. | DISTRIBUTION OF MARKS | | | | | | Total Marks | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Theory | | | Practical | | | | |
| | | | L | T | P | Lab | | Assmt. Marks | Final Marks | Time Hrs. | Assmt. Marks* | Final Marks | Time Hrs. | | |
| 1 | EG 3201 CE | Field Survey Camp | At the beginning of sixth semester, survey camp of 8 days (per day 10 Hrs. = 80 Hrs.) will be conducted. | | | | | | | | 60 | 40 | 4 | 100 | |
| 2 | EG 3202 CE | Transportation Engineering II | 3 | | | | 3 | 20 | 80 | 3 | | | | 100 | |
| 3 | EG 3203 CE | Estimating and Costing III | 3 | 3 | | | 6 | 20 | 80 | 3 | | | | 100 | * Continuous assessment |
| 4 | EG 3204 CE | Water Resources and Irrigation Engineering | 4 | 2 | 2 | | 8 | 20 | 80 | 3 | 30 | 20 | 3 | 150 | |
| 5 | EG 3201 MG | Entrepreneurship Development | 3 | | 2 | | 5 | 20 | 60 | 3 | 10 | 10 | 2 | 100 | |
| 6 | EG 3205 CE | Project Work | | | 10 | | 10 | | | | 60 | 40 | 4 | 100 | |
| 7 | EG 3206 CE | Elective (One of the followings) | 3 | | 3 | | 6 | 20 | 80 | 3 | 30 | 20 | 3 | 150 | |
| | | A: Trail Bridge | | | | | | | | | | | | | |
| | | B: Hill Road | | | | | | | | | | | | | |
| | | C: Hill Irrigation Engineering | | | | | | | | | | | | | |
| | | D: Gravity Flow Water Supply System | | | | | | | | | | | | | |
| | | E. Micro Hydro Power Engineering | | | | | | | | | | | | | |
| **TOTAL** | | | **16** | **5** | **17** | | **38** | **90** | **360** | | **205** | **120** | | **775** | |

**First Year**
First and Second Semesters

# [See Separate Curriculum First Year (First and Second Semester) Engineering All]

**Second Year**
(Third and Fourth Semesters)

**Third Semester**
**Subjects:**

| | | |
|---|---|---|
| 1 | EG 2101 SH | Engineering Mathematics III |
| 2 | EG 2101CE | Surveying I |
| 3 | EG 2102 CE | Workshop Practice II |
| 4 | EG 2103 CE | Fluid Mechanics and Hydraulics |
| 5 | EG 2104 CE | Building Construction |
| 6 | EG 2105 CE | Engineering Materials |

**Engineering Mathematics III**

EG2101SH

Year: II
Semester: I

Total: 4 Hrs./week
Lecture: 3 Hrs./week
Tutorial: 1 Hrs./week
Practical: Hrs./week
Lab: Hrs./week

**Course Description:**

This course consists of five units namely: Applications of derivatives, Partial derivatives, application of Anti-derivatives, Differential equations and Fourier series; which are basically necessary to develop mathematical knowledge and helpful for understanding as well as practicing their skills in the related engineering fields.

**Course Objectives:**

On completion of this course, students will be able to understand the concept of the following topics and apply them in the related fields of different engineering areas: Applications of derivatives and anti-derivatives, Partial derivatives, differential equations and Fourier series.

**Course Contents**

**Unit 1: Applications of Derivatives [12 Hrs]**

1.1 Derivatives of inverse circular functions and hyperbolic functions
1.2 Differentials, tangent and normal
1.3 Maxima and minima, concavity, increasing and decreasing functions
1.4 Rate measures
1.5 Indeterminate forms: $\frac{0}{0}$, $\frac{\infty}{\infty}$ and $\infty - \infty$, L'Hospital's Rule (without proof)

**Unit 2: Partial Derivatives [6 Hrs]**

2.1 Functions of more than two variables
2.2 Partial derivative from First principles
2.3 Partial derivatives of First and higher orders
2.4 Euler's theorem for function of two variables
2.5 Partial derivatives of composite functions

**Unit 3: Applications of Anti-derivatives [8 Hrs]**

3.1 Standard Integrals, related numerical problems
3.2 **Basic idea of curve sketching:** odd and even functions, periodicity of a function, symmetry (about *x*-axis, *y*-axis and origin), monotonicity of a function, sketching graphs of polynomial, trigonometric, exponential, and logarithmic functions (simple cases only)
3.3 Area under a curve using limit of sum (without proof)
3.4 Area between two curves (without proof)
3.5 Area of closed a curve (circle and ellipse only)

**Unit 4: Differential Equations [14 Hrs]**

**4.1 Ordinary Differential Equations (ODEs)**

- Definitions, order and degree of differential equation
- Differential equation of First order and First degree
- Variable separation and variable change methods

- Homogeneous and linear differential equation of First order
- Exact differential equation, condition of exactness
- Simple applications of First order differential equations

**4.2 Partial Differential Equations (PDEs)**

- Basic concepts, definition and formation
- General solution of linear PDEs of first order (Pp + Qq = R form)

**Unit 5: Fourier Series** **[5 Hrs]**

5.1 Periodic functions and fundamental period of periodic functions
5.2 Odd and even functions with their properties
5.3 Trigonometric series
5.4 Fourie's series in an interval of period 2π (arbitrary range is not required)

**Tutorial** **[15 Hrs]**

1. Applications of Derivatives [**4 Hrs]**
2. Partial Derivatives [2 Hrs]
3. Applications of Anti-derivatives [3 Hrs]
4. Differential Equations [5 Hrs]
5. Fourier Series [1 Hrs]

**Evaluation Scheme**

**Unit wise Marks division for Final**

| S. No. | Units | Short questions (2 marks) | Long questions (4 marks) | Total Marks |
|---|---|---|---|---|
| 1 | Applications of Derivatives | 4 x 2 = 8 | 3 x 4 = 12 | 20 |
| 2 | Partial Derivatives | 2 x 2 = 4 | 2 x 4 = 8 | 12 |
| 3 | Applications of Anti-derivatives | 3 x 2 = 6 | 3 x 4 = 12 | 18 |
| 4 | Differential Equations | 4 x 2 = 8 | 4 x 4 = 16 | 24 |
| 5 | Fourier Series | 1 x 2 = 2 | 1 x 4 = 4 | 6 |
| | | **14 x 2 = 28** | **13 x 4 = 52** | **80** |

**Reference Books**


1. Thapa et al., Engineering Mathematics (Volume I, Three Years Diploma), Sukunda Pustak Bhawan, Bhotahity, Kathmandu, Nepal
2. Bajracharya et al., Basic Mathematics (Grade XI/XII), Sukunda Pustak Bhawan, Bhotahity, Kathmandu, Nepal
3. Kryszig E., Advanced Engineering Mathematics, wile-Easter Publication, New Delhhi, India
4. Nath et al., Engineering Mathematics III, Vidhyarthi Publisher & distributors, Kathmandu, Nepal
5. Other references selected by the related lecturer(s) from among the texts available in the market that meet the content of this subject.

**Surveying I**
**EG 2101CE**

Year: II
Semester: I

Total: 7 Hrs./week
Lecture: 3 Hrs./week
Tutorial: Hrs./week
Practical: 4 Hrs./week
Lab: Hrs./week

**Course Description**

This course focuses on familiarization on different surveying techniques and handling of surveying equipment. The different surveying techniques include linear, angular, vertical measurements, and plotting skills.

**Course Objective**

After the completion of this course, students will be able to:

1. Apply distance measurement techniques.
2. Use basic surveying techniques and plotting of plan and map.

**Course Content**

**Theory**

**Unit 1: Introduction to surveying [4 Hrs.]**

- 1.1 Definition and Purpose of surveying
- 1.2 Classification of surveying
- 1.3 Principles of surveying
- 1.4 Units of measurements
- 1.5 Definition of Scale, Types of Scale – Plain, Diagonal and Vernier Scale, Scale of chord, Scale conversion
- 1.6 Maps and Conventional symbols

**Unit 2: Errors, Accuracy, and Correction [2 Hrs.]**

- 2.1 Sources of errors, Types of error – Mistake, Systematic error, and Random error
- 2.2 Accuracy and Precision in surveying, Permissible Error, and Correction

**Unit 3: Linear Distance Measurement [8 Hrs.]**

- 3.1 Linear distance measurement with Chain, Tape, and Pedometer
- 3.2 Ranging survey lines, Direct ranging, and Indirect or Reciprocal ranging
- 3.3 Linear distance measurement on smooth level ground
- 3.4 Introduction to Abney hand level, and simple calculation
- 3.5 Linear distance measurement on sloping ground – Direct method, and Indirect method
- 3.6 Errors in chaining
- 3.7 Tape correction for – Standard Length/Slope/Tension (Pull)/Temperature/and Sag

**Unit 4: Chain Surveying [6 Hrs.]**

- 4.1 Principles of chain surveying
- 4.2 Meaning of the Terms – Survey line/Base line/Check line/Tie line/Offset/Station
- 4.3 Reconnaissance, Selection and Fixing of Survey stations
- 4.4 Referencing and Marking of stations
- 4.5 Perpendicular offset and Oblique offset
- 4.6 Obstacles in chaining, Computation of width of river

4.7 Field work in chain surveying, Field Book and Booking the data
4.8 Plotting a chain survey

**Unit 5: Compass Surveying [12 Hrs.]**

5.1 Compass – Prismatic compass, and Surveyor's compass, Temporary adjustment of compass
5.2 Meridian – True meridian/Magnetic meridian/Arbitrary meridian
5.3 Bearing – True bearing/Magnetic bearing/Arbitrary bearing
5.4 Magnetic declination, Variation of Magnetic declination
5.5 Local attraction, Detection and elimination of local attraction
5.6 Whole circle bearing system (WCB), Reduced or Quadrantal bearing system (RB/QB), Conversion of WCB to QB, and Conversion of QB to WCB,
5.7 Fore bearing, Back bearing, Relationship between Fore bearing and Back bearing
5.8 Calculation of angles from bearings, and Calculation of bearings from angle
5.9 Definition of traverse, Types of traverse – Closed traverse, and Open traverse, Compass traverse, Angular error in compass traverse, Angular correction in compass traverse, and Bearing correction in compass traverse
5.10 Graphical adjustment of traverse
5.11 Field problems and procedures

**Unit 6: Leveling [13 Hrs.]**

6.1 Principles of leveling – Simple leveling, and Differential leveling
6.2 Instruments used in leveling – Level, and Leveling staff
6.3 Definition of the terms – Levelling/Datum/Benchmark/Reduced level/ Line of collimation/Line of Sight/Back sight/Intermediate sight/Fore sight/Change point
6.4 Types of Level – Tilting level/Dumping level/Automatic level
6.5 Curvature and Refraction
6.6 Temporary adjustment of level
6.7 Classification of leveling - Simple leveling/Differential leveling/Fly leveling/ Reciprocal leveling/Profile leveling/Cross-sectioning/Check leveling/Precise leveling
6.8 Two peg tests
6.9 Balancing Back sight distance and Fore sight distance
6.10 Field Procedure in levelling, Use of inverted staff
6.11 Booking and reducing levels – Height of instrument method/Rise and Fall method
6.12 Error in leveling, Permissible Error in leveling, Error adjustment in closed circuit
6.13 Plotting of Profile leveling and Cross-sectioning

**Practical (Field work)**

1 Perform Pacing/Measure linear distance on plane and sloping ground. [8 Hrs.]
2 Perform Chain triangulation and detailing [16 Hrs.]
3 Perform Compass traversing and detailing [16 Hrs.]
4 Perform Leveling – Simple leveling, Differential leveling, Two peg test, Fly leveling,
5 Profile leveling and cross sectioning [20 Hrs.]

**Evaluation of Practical**

Continuous evaluation (Viva + Instrumentation + Objective test)

**Text Books**

1. R. Agor," Surveying and Leveling", Khanna Publication New Delhi.
2. Dhakal B.B. and Karki B.K.," Engineering Surveying I &II", Heritage Publishers and Distributers Pvt. Ltd., Kathmandu, Nepal.

**Reference Books**

3. N Basnet and M Basnet, "Basic Surveying – I & II", Benchmark Education Support Pvt. Ltd., Tinkune Kathmandu and Rajmati Press, Lalitpur.
4. S K Duggal, "Surveying" Vol I and II, Tata MC Graw Hill Publishing.
5. Dr. B. C Punmia, " Surveying " Vol I and II, Laxmi Publication New Delhi

**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. | Marks distribution* |
|---|---|---|---|
| 1 | Introduction | 04 | 04 |
| 2 | Errors, Accuracy, and Correction | 02 | 04 |
| 3 | Linear Distance Measurement | 08 | 16 |
| 4 | Chain Surveying | 06 | 08 |
| 5 | Compass Surveying | 12 | 24 |
| 6 | Levelling | 13 | 24 |
| **Total** | | **45** | **80** |

* There may be minor deviation in marks distribution.

**Workshop Practice II**
**EG 2102 CE**

Year: II
Semester: I

Total: 12 Hrs. /week
Lecture: 3 Hrs./week
Tutorial: Hrs./week
Practical: 9 Hrs./week
Lab: Hrs./week

**Course Description:**
This course intends to impart basic knowledge and skills on bricklaying and plumbing works.

**Course Objectives:**
After the completion of this course students will be able to:
1. Introduce brick laying;
2. Introduce household plumbing:
3. Perform different bricklaying works.
4. Perform simple plumbing joining and installation works.

**Part I: Bricklaying**

**Total: 4 Hrs. /week**
**Lecture: 1 Hr./week**
**Tutorial: Hrs./week**
**Practical: 3 Hrs./week**

**Course Description:**
This part of the course focuses on familiarization of bricklaying and its standard requirements to be used on to-days construction. It also deals with pointing and curing works.

**Course Objectives:**
After the completion of this course students will be able to:
1. Introduce bricklaying;
2. Identify major operation related to civil engineering works;
3. Identify and select the tools and equipment required for bricklaying and
4. Perform bricklaying works on various bonding patterns.

**Course Contents:**

**Theory**

**Unit 1: Bricklaying:** **[1 Hr.]**
- 1.1. Introduction
- 1.2. History of Bricklaying
- 1.3. Importance of Bricklaying
- 1.4. Scope of Bricklaying
- 1.5. Beauty of Bricklaying (Aesthetics of Bricklaying)

**Unit 2: Safety Precaution:** **[1 Hr.]**
- 2.1. Use of protective clothing and equipment
- 2.2. Maintaining tools and equipment
- 2.3. Awareness of personal safety and safety of others in all aspects of works
- 2.4. Observation of workshops safety rules and regulations

**Unit 3: Bricklaying Materials:** **[2 Hrs.]**

3.1. Bricks in common use
3.2. Bricks in Chinese bricks/Dachi Bricks
3.3. Bricks in hand made bricks
3.4. Bricks in 5% cement added sun dried soil bricks
3.5. sand used in Bricklaying
3.6. Lime/Cement used in Bricklaying
3.7. Amount of water used in mixing Mortar/concrete
3.8. Admixture and their properties.

**Unit 4: Use of Hand Tools:** **[1 Hr.]**

4.1. Introduction
4.2. Types of bricklaying hand tools: trowel, pointing trowel, plum bob, sprit level, line and pin/corner block, Mason's line, Straight edge/storey rod, Gang rod, Club Hammer, Bolster and closer or bat gauge.

**Unit 5: Handling Bricklaying Equipment/Machines:** **[1 Hr.]**

5.1. Shovel, spade, wheel barrow, buckets, jugs, sponge, Hesign Rags, Foam, Runner/Jointer, Mortar Boards, Mortar pan and Brooms for cleaning floor
5.2. Protective equipment e.g. Hand gloves, ear plugs and Mask etc.
5.3. Mortar mixer

**Unit 6: Constructing Walls using Bricks in lime mortar English Bond:** **[2 Hrs.]**

6.1. Building ½ Brick (4.5" thick wall) to stretcher Bond
6.2. Building 1 Brick (9" thick wall) to English Bond

**Unit 7: Constructing Walls: Using Bricks in lime mortar: Flemish Bond:** **[2 Hrs.]**

7.1. Flemish Bond-1 Brick thick, 1.5 Brick and 2 brick thick double Flemish bond wall.
7.2. Making of one end stopped and other end racked back.
7.3. Constructing cavity wall, 12" thick making cavity of 3” wide.
7.4. Constructing rat trap bond 1 brick thick (9" thick wall)

**Unit 8: Pointing:** **[2 Hrs.]**

8.1 Introduction
8.2 Mortar for pointing/Ratio and proportion
8.3 Pointing procedure
8.4 Pointing as the work proceeds
8.5 Pointing after the Brick work is completed
8.6 Types of pointing:
  (a) flush pointing
  (b) Struck joint or pointing
  (c) Weather struck and cut pointing
  (d) Rounded or tooled pointing
  (e) Recessed pointing
  (f) Tuck pointing
  (g) V-joint pointing
  (h) Purpose of pointing
  (i) Advantage of pointing.

**Unit 9: Curing Walls:** **[1 Hr.]**

9.1 Curing wall both side by water pouring from top
9.2 Curing wall both side by sprinkling water at face
9.3 Temporary covering wall by heavy rain, frost and dirty materials nearby building operation
9.4 Liquid curing in hot climate
9.5 Cleaning wall by chemicals and acids

**Unit 10: Building Foundation Footing Courses Wall (Square footing):** **[2 Hrs.]**

10.1 2.5 Bricks*2.5 Bricks square footing
10.2 3.5 Bricks*3.5 Bricks square footing
10.3 3.0 Bricks*3.0 Bricks square footing
10.4 Purpose and advantage of foundation footing

## Practical

**Project-1** **[5Hrs.]**

Identify and handle tools/equipment/materials related to bricklaying.

**Project -2** **[4 Hrs.]**

2.1 Prepare workshop floor area and set out the work area
2.2 Prepare/handle/spread mortar with trowel
2.3 Lay stretcher bond wall making 1.5 m long and 6 courses high true to horizontal and vertical line and level properly.

**Project -3** **[4 Hrs.]**

3.1 Prepare workshop floor area and set out the work area
3.2 Prepare/handle/spread mortar with trowel
3.3 Build English bond wall 1 brick thick (9") up to 6 courses high and ending at 1.5 m length true to horizontal and vertical line and level properly.

**Project -4** **[4 Hrs.]**

4.1 Prepare workshop floor area and set out the work area
4.2 Prepare/handle/spread mortar with trowel
4.3 Build Flemish bond wall 1 brick thick (9") up to 6 courses high and ending at 1.5 m length true to horizontal and vertical line and level properly

**Project -5** **[4 Hrs.]**

5.1 Prepare workshop floor area and set out the work area
5.2 Prepare/handle/spread mortar with trowel
5.3 Build English bond wall 1 brick thick (9") up to 6 courses high and 1.5m length with return corner true to horizontal and vertical line and level properly.

**Project -6** **[4 Hrs.]**

6.1 Prepare workshop floor area and set out the work area
6.2 Prepare/handle/spread mortar with trowel
6.3 Build Flemish bond wall 1 brick thick (9") up to 6 courses high and 1.5m length with return corner true to horizontal and vertical line and level properly.

**Project -7** **[5 Hrs.]**

7.1 Prepare workshop floor area and set out the work area

7.2Prepare/handle/spread mortar with trowel

7.3Build a T-junction 1 brick thick main wall with 1.5 m length in English bond and partition wall with 1.5 m length in stretcher bond up to 6 courses high.

**Project -8** **[5 Hrs.]**

8.1Build a T-junction 1 brick thick main wall with 1.5 m length in Flemish bond and partition wall with 1 m length in stretcher bond up to 6 courses high

**Project -9** **[5 Hrs.]**

9.1 Build a cross-junction 1 brick thick main wall with 1.5 m length in English bond and partition cross wall with 1 m length both side in stretcher bond up to 6 courses high.

**Project -10** **[5 Hrs.]**

10.1Build a cross-junction 1 brick thick main wall with 1.5 m length in Flemish bond and partition cross wall with 1 m length both side in stretcher bond up to 6 courses high.

**References:**


1. Punmia, B.C., Jain, A.K.,(latest edition). Building Construction, Laxmi publication pvt.ltd.
2. Byanjakar, Mohan Man, (latest edition). Garo laghaune prabidhi


**Evaluation Scheme**

No. of students in each shift = 16
No. of students in each group= 2
No. of groups =8

| S. N | Description | Time (Hrs.) | Marks |
|---|---|---|---|
| 1 | Any one project from project no. 3 to 10 | 36 | 24 |
| 2 | Viva from theory | | 6 |
| | **Total** | | **30** |

## Part II: Plumbing

Total: 4 Hrs. /week
Lecture: 1 Hr./week
Tutorial: Hrs./week
Practical: 3 Hrs./week

**Courses Description:**
This part of the course focuses on familiarization of plumbing works related to civil constructions. It also includes basic knowledge and skills on welding and bar bending.

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

1. Apply operating systems of plumbing works;
2. Identify the tools and equipment required to plumbing works;
3. Perform simple pipe fittings works and
4. Prepare the PVC fittings.

**Course Contents:**

**Theory**

**Unit 1: Introduction to Plumbing:** **[1 Hr.]**

1.1. History of plumbing.
1.2. Importance of plumbing
1.3. Plumbing and sanitary
1.4. Scope of plumbing

**Unit 2: Plumber's Hand Tools:** **[2 Hrs.]**

2.1. Pipe wrench of size 12", 9", and up to 18" long.
2.2. Pair of footprints.
2.3. Stocks and dies, up to 2" diameter, replacement of cutters
2.4. Wrench chain
2.5. Hack's saw frame and blade
2.6. Measuring tape
2.7. Soldering iron
2.8. Tin snips
2.9. Rasp
2.10. Caulking iron
2.11. Adjustable wrench up to 12 long.
2.12. Claw hammers /Ball pin hammer/Claw hammer
2.13. Pipe cutter-use and care adjustment of cutting wheels.
2.14. Drilling machine and its bits.
2.15. Pipe vise
2.16. Bench vice
2.17. Spanners of various size
2.18. Folding rules metallic/steel
2.19. Try square, Vernier caliper joining elements: - Nuts, bolts, washer, pins, screws and rivets and jute/pipe tape and lead.

**Unit 3: Galvanized Pipe Fittings:** **[2 Hrs.]**

3.1. G.I pipe nipples
3.2. G.I. elbows
3.3. G.I tee

3.4. G.I cross
3.5. G.I reducing elbow
3.6. G.I reducing tee and reducing cross
3.7. G.I sockets
3.8. G.I reducing sockets
3.9. G.I lock nut
3.10. G.I plugs or caps
3.11. Flange unions (Gasket)
3.12. G.I gate valve (heavy and light)
3.13. Foot valve/Glove valve
3.14. Pipe tape
3.15. Float valve or ball valve.

**Unit 4: Pipe Threading to Dimension: [2 Hrs.]**

4.1. Fixing pipe to pipe vice
4.2. Measuring pipe to millimeter
4.3. Measuring methods
4.4. Die holding/threading methods
4.5. Die checking/cleaning/oiling
4.6. Die tightening and loosing/fixing cutter
4.7. Checking accurate threading and its sharpness
4.8. Doing loosen the die fixing the pipe to die and repeat the threading twice for sharpness. (Repeat)

**Unit 5: Assembling the Threaded Pipe to Fittings with Pipe Tape [2 Hrs.]**

5.1. Visualization of drawing in detail
5.2. Collecting the fittings
5.3. Collecting the threaded pipes in position
5.4. Fixing the fittings with pipe tape to pipe in position
5.5. checking the tightness/testing pipe joints
5.6. Adjusting measurement
5.7. Marking, laying, using chalk line to wall/floor/ceiling
5.8. Accurate pipe cutting with margin of necessary threads to pipe
5.9. Fixing pipe to pipe vice
5.10. Positioning techniques.

**Unit 6: H.D.P fittings: [3 Hrs.]**

6.1. Definition of HDP pipe and fittings
6.2. Collecting hot plate with power
6.3. Collecting HDP pipe with necessary diameters
6.4. using miter box cutting pipe to $90^0$
6.5. Clean, trim and weld the two halves of pipe to form $90^0$ elbow (L)
6.6. Making Tee
6.7. Making Wyes(Y)

**Unit 7: P.V.C. fittings: [3 Hrs.]**

7.1 Definition of PVC pipe and fittings
7.2 Collecting hot plate with power
7.3 Collecting PVC pipe with necessary diameters
7.4 Using miter box cutting pipe to 900
7.5 Clean, trim and join the two halves of pipe to form 900elbow (L)

7.6 Making Tee
7.7 Making Wyes(Y)

**Practical**

1. Identify/enumerate/use hand tools and equipment [1 Hrs.]
2. Demonstrate various types of pipes with different sizes. [2 Hrs.]
3. Cut, file cut end and make thread to prepare nipples of different sizes of G.I pipe needed for assembling [6 Hrs.]
4. Assemble previously threaded pipes and fittings to make a loop by using various fittings as Elbow, Union and tee. [5 Hrs.]
5. Make L, cross and T bends of HDP pipe [6 Hrs.]
6. Join HDP fittings with HDP pipe. [3 Hrs.]
7. Make L, cross and T bends of PVC pipe [6 Hrs.]
8. Join PVC fittings with PVC pipe. [4 Hrs.]
9. Install PPR pipe with fittings. [6 Hrs.]
10. Perform external (wall) pipe layout and join fittings for water supply. [6 Hrs.]

**References:**


1. Birdie, G.S., Birdie, J.S., (latest edition). Water supply and sanitary engineering.
2. Deolakar, S.G.,(1994). Plumbing Design and Practice, Tata McGraw-Hill Publishing Company Limited.
3. McConnell, C., (1986). Plumbers and pipe fitters library, volume I, II, and III, Macmillan publishing company.
4. Tailor, J.D., I.L.O., (1975). Plumbing practice vol 1.
5. Pudasaini Loknath (2019), Plumbing handbook, Bhudipuran publication


**Evaluation Scheme**

No. of students in each shift = 16
No. of students in each group= 2
No. of groups =8

| S. N | Description | Time (Hrs.) | Marks |
|---|---|---|---|
| 1 | make thread to prepare nipples of different sizes of G.I pipe | 6 | 3 |
| 2 | Make cross of HDP pipe | 6 | 3 |
| 3 | Join HDP cross with HDP pipe. | 3 | 3 |
| 4 | Make cross of PVC pipe | 6 | 3 |
| 5 | Join PVC cross with PVC pipe. | 6 | 3 |
| 6 | Viva voce from theory | | 5 |
| | **Total** | | **20** |

## Part III: Carpentry and Scaffolding

Total: 4 Hrs./week
Lecture: 1 Hr./week
Tutorial: Hrs./week
Practical: 3 Hrs./week

**Course Description:**
This part of the course focuses on familiarization of carpentry work and its tools and equipment required. It intends to provide knowledge and skills on Timber seasoning, Detecting timber defects and joints and Wood carving techniques.

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

1. Explain principles of carpentry works;
2. Select and collect the hand tools required for conduction of carpentry works;
3. Apply the technology of wood and its conversion techniques and
4. Perform shaving and joints making**.**

**Course Contents:**

**Theory**

**Unit 1: Introduction to Carpentry: [1 Hr.]**

- 1.1. Introduction and uses of hand tools/equipment
- 1.2. Types of carpentry trades as per
  - 1.2.1. Carpenter
  - 1.2.2. Joiner
  - 1.2.3. Cabinet and furniture maker
  - 1.2.4. Tree cutter and lumber producer
  - 1.2.5. Wood working machine setter-operator

**Unit 2: Wood as Construction Materials: [1 Hr.]**

- 2.1. Temporary structure
- 2.2. Structural medium (permanent structure)
- 2.3. Joinery works
- 2.4. Furniture making
- 2.5. Tools handle making
- 2.6. Plywood makings

**Unit 3: Methods of Conversion of Lumber (Log): [1 Hr.]**

- 3.1 Ordinary sawing
- 3.2 Tangential sawing
- 3.3 Radial sawing
- 3.4 Quarter or rift sawn

**Unit 4: Identifying and Enumeration of Hand and Power Tools: [1 Hr.]**

- 4.1 Different hand tools (Lay Out Tools, Tooth edge cutting tools (Straight line cutting saw, Curve line cutting saw, Saving Tools, Shaping Tools, Drilling and Boring, Striking and Driving)
- 4.2 Different types of power tools

**Unit 5: Insects and Wood borers:** **[1 Hr.]**

5.1 Define Borers
5.2 Identify termites or white ants
5.3 Removal of termites
5.4 Reason of termites develop in home
5.5 Wood preservatives
5.6 Defects caused by dampness

**Unit 6: Simple and Complicated Wood joints:** **[4Hrs.]**

6.1 Function of joint
6.2 Types of joints (Lengthening, widening and framing joints)
6.3 Miscellaneous joints
6.4 Types of beam hangers
6.5 Use of gusset plates in framings of frame construction
6.6 Uses and application of;
   A. Lengthening joint
      a. Table scarf joint
      b. Spliced joint
   B. Widening joint
      a. Butt joint
      b. Tongued and grooved joint
      c. Dowel joint
      d. Tongued and grooved joint with chips
   C. Framing joint
      a. Dovetail bridle joint
      b. Tusk tenon joint
   D. Rail joint
      a. Stub mortise and tenon joint with hunch
      b. Housing joint

**Unit 7: Plywood:** **[1 Hr.]**

7.1 Definition
7.2 Types
7.3 Sanding
7.4 Properties of plywood

**Unit 8: Formworks:** **[2 Hrs.]**

8.1 Requirements of formworks
8.2 Various Loads on formwork
8.3 Shuttering for column
8.4 Shuttering and centering for beam

**Unit 9: Scaffolding:** **[3 Hrs.]**

9.1 Definition and component parts
9.2 Single or brick layer (wood/bamboo) scaffolding
9.3 Double or mason (wood /bamboo) scaffolding
9.4 Cantilever or needle scaffolding
9.5 Tubular (single and double) scaffolding

**Practical** **[45 Hrs.]**

1.Make cross lap joint [2Hrs.]
2. Make notched joint [2Hrs.]
3.Make dovetail half lap joint [2Hrs.]
4.Make mortise and tenon joint [2Hrs.]
5. Make Rebated butt joint [2Hrs.]
6. Prepare a tool using above joints. [5Hrs.]
7.Make formwork for Square or Rectangular column. [5Hrs.]
8.Make formwork for beam [5Hrs.]
9.Make single scaffolding using wood/bamboo. [5Hrs.]
10.Make double scaffolding using wood /bamboo. [5Hrs.]
11.Make single tubular scaffolding [5Hrs.]
12.Make double tubular scaffolding [5Hrs.]

**References:**


1. Singh Surendra.,(latest edition). Engineering materials, Vikas publishing house pvt.ltd.
2. Silakar, D.L., (2054). An introduction of wood work.
3. Pudasaini, Lok Nath., (2075). Wood and woodwork technology, Bhudipuran publication.
4. Byanjankar, Mohan Man, (1996). The essential views in carpentry and masonry, Nepal Engineering College
5. Sthapit, Chinikaji, Baidhya Keshav Das, (latest edition). Sikarmi byabasaya.
6. Punmia, B.C., Jain, A.K.,(latest edition).Building construction, Laxmi publication pvt.ltd


**Evaluation Scheme**

No. of students in each shift = 16
No. of students in each group= 2
No. of groups =8

| S. N | Description | Time (Hrs.) | Marks |
|---|---|---|---|
| 1 | Make a cross lap joint or a notched joint or a dovetail half lap joint or a mortise and tenon joint | 8 | 5 |
| 2 | Make formwork for a square or rectangular column or a formwork for a beam | 10 | 10 |
| 3 | Make single or double tubular scaffolding or single or double scaffolding using wood/bamboo | 20 | 10 |
| 4 | Viva voce from theory | | 5 |
| | Total | | 30 |

**The overall assignment will be as follows:**

| | | Assessment marks | Final marks |
|---|---|---|---|
| A. Bricklaying | 4 Hrs. /week | 45 | 30 |
| B. Plumbing | 4 Hrs. /week | 30 | 20 |
| C. Carpentry & Scaffolding | 4 Hrs. /week | 45 | 30 |

**Fluid Mechanics and Hydraulics**
**EG 2103 CE**

Year: II
Semester: I

Total: 5 Hrs. /week
Lecture: 3 Hrs./week
Tutorial: 1 Hr./week
Practical: Hrs./week
Lab: 2/2 Hrs./week

**Course Description:**
This course focuses on the fundamental concepts and principles of Hydraulics, measurement of flow, introduction to open channel flow and pipe flow.

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

1. Understand the properties of fluid;
2. Analyze the behaviour of fluid at rest;
3. Analyze the behaviour of fluid in motion;
4. Apply the measurement techniques for pressure and discharge;
5. Understand the concept of head loss in pipe flow and
6. Understand the basic concept of open channel flow.

**Course Contents:**

**Theory**

**Unit 1: Introduction to Fluid Mechanics and Hydraulics [3 Hrs.]**

1.1 Introduction: Fluid, Fluid Mechanics and Hydraulics
1.2 Properties of fluid (Definition, formula, unit and dimension): mass density, specific weight, specific volume, specific gravity, viscosity (Dynamic and kinematic viscosity), Newton's law of viscosity, surface tension, capillarity, compressibility and Bulk Modulus.
1.3 Difference between real and ideal fluid, Newtonian and Non-Newtonian fluid, Compressible and incompressible fluid.

**Unit 2: Hydrostatics: [10 Hrs.]**

2.1 Introduction to fluid pressure
2.2 Derivation for Pascal's law and pressure-depth relationship (Hydrostatic law)
2.3 Relationship of atmospheric pressure, Vacuum pressure, gauge pressure and absolute pressure
2.4 Measurement of pressure by piezometer and U-tube manometer
2.5 Definition of total pressure and center of pressure
2.6 Derivation for total pressure and center of pressure on horizontal, vertical and inclined plane submerged surface
2.7 Principle of floatation
2.8 Definition of Buoyancy and Archimedes' principle
2.9 Introduction to relative equilibrium

**Unit 3: Hydro kinematics: [5 Hrs.]**

3.1 Types of flow: Steady and unsteady, uniform and non-uniform, laminar and turbulent, compressible and incompressible, rotational and irrotational, one, two and three dimensional
3.2 Reynold's number: Definition, equation and criteria for laminar and turbulent flow

3.3 Streamline: Definition, equation, characteristics
3.4 Conservation principles of mass, energy, momentum and continuity equation for one dimensional incompressible flow

**Unit 4: Hydrodynamics: [3 Hrs.]**

4.1 Energy of flowing fluid: potential or datum energy, kinetic energy, pressure energy
4.2 Concept of energy head
4.3 Bernoulli's theorem: Statements, assumptions, equation and applicability
4.4 Concept of Hydraulic gradient line (HGL) and energy gradient line (EGL)

**Unit 5: Flow Measurement: [10 Hrs.]**

5.1 Orifice: Definition and types, definition of vena-contracta
5.2 Derivation of equation for discharge through small orifice
5.3 Hydraulic coefficients of orifice: coefficient of discharge, velocity and contraction (definition, formula and experimental method of determination)
5.4 Concept of venturimeter, derivation of equation for discharge through venturimeter
5.5 Introduction to weir or notch and their classifications
5.6 Derivation of equation for discharge through rectangular, triangular and trapezoidal weir or notch
5.7 Area-velocity method for the discharge measurement in open channel (float and current meter): description of measurement technique, mid-section method for discharge computation

**Unit 6: Pipe Flow: [6 Hrs.]**

6.1 Introduction to pipe flow
6.2 Shear stress, Velocity profile for laminar and turbulent flow through pipes
6.3 Loss of head in pipes: introduction to major and minor loss such as entry, expansion, contraction, fitting, bend, obstruction, exit loss
6.4 Derivation of Loss of head in pipes in laminar (Hagen Poiseuille equation) and turbulent flow (Darcy-Weisbach equation)
6.5 Derivation of equation for expansion and contraction loss

**Unit 7: Open Channel Flow: [8 Hrs.]**

7.1 Difference between pipe flow and open channel flow
7.2 Types and classification of open channel flow: steady and unsteady, uniform and non-uniform, prismatic and non-prismatic, natural and artificial, (gradually varied, rapidly varied and spatially varied flow), laminar and turbulent, subcritical, critical and supercritical flow
7.3 Geometric elements of open channel (flow depth, depth of flow section flow area, top width, wetted perimeter, hydraulic radius, hydraulic depth, section factor, conveyance)
7.4 Velocity distribution in open channel flow
7.5 Chezy's equation and Manning's equation for the computation of velocity in uniform flow
7.6 Introduction to most efficient and economical section in open channel flow.
7.7 Energy equation and momentum equation in open channel flow
7.8 Specific energy: Definition, equation and diagram and Critical flow criteria, alternative depth, conjugate depth.

**Tutorials:** **[15 Hrs.]**

1. Numericals of fluid properties (1)
2. Pressure computation, Pressure measurement by piezometer and U-tube manometer, Total pressure and center of pressure for horizontal, vertical and inclined submerged surface, principle of floatation (3)
3. Computation of discharge by using continuity equation, computation of Reynold's number and identifying type of flow (2)
4. Application of Bernoulli's equation with and without head loss, Draw HGL, and EGL. (1)
5. Computation of hydraulic coefficients, and discharge through orifice, venturimeter, rectangular, triangular and trapezoidal weir, mid-section method for discharge computation (3)
6. Computation of Shear stress, velocity and Head loss (Major and minor) computation in pipe flow (2)
7. Computation of Cross-sectional properties, velocity, discharge and flow depth computation for uniform flow through open channel, Critical flow parameters such as depth, velocity, energy and alternative and conjugate depths. (3)

**Practical (Laboratory)** **[15 Hrs.]**

1. Measure major (i.e. friction) and minor (Contraction, expansion) head losses in pipe
2. Measure pressure by piezometer and manometer
3. Verify the Bernoulli's equation
4. Measure flow through orifice

**Textbooks:**


1. D. P. Sangroula "Fundamentals of Fluid Mechanics', Nepal Printing Support, Anamnagar, Kathmandu
2. P.N. Modi and S. M. Seth "Fluid Mechanics and Hydraulics, Standard Book House
3. D.S. Kumar "Fluid Mechanics and Fluid power Engineering', S.K. Kataria and Sons
4. S Ramamrutham 'Hydraulics fluid mechanics and fluid machines' Dhanpat Rai Publishing Company (P) Ltd. New Delhi.
5. R.K. Rajput, *"Fluid Mechanics and Hydraulic Machines"*, S. Chand & Company Ltd.


**References:**


1. 2. A.K. Upadhyay, *"Hydraulics and Pneumatics"*, S.K. Kataria and Sons.
2. R.K. Bansal, *"Fluid Mechanics and Hydraulic Machines"*, Laxmi Publications (P) Ltd.


**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 Fluid Mechanics and Hydraulics | 3+1=4 | 4 |
| 2 | Hydrostatics | 10+3=13 | 20 |
| 3 | Hydro kinematics | 5+2=7 | 8 |
| 4 | Hydrodynamics | 3+1=4 | 4 |
| 5 | Flow Measurement | 10+3=13 | 16 |
| 6 | Pipe Flow | 6+2=8 | 12 |
| 7 | Open Channel Flow | 8+3=11 | 16 |
| | **Total** | 60 Hrs | 80 |

**Building Construction**
**EG 2104 CE**

**Year: II** **Total: 7 Hrs. /week**
**Semester: I** **Lecture: 6 Hrs./week**
**Tutorial: 0 Hr./week**
**Practical: 0 Hr./week**
**Lab: 2/2 Hr./week**

**Course Description:**
This course is designed to provide knowledge and skills in building construction techniques and technology including earthquake resisting construction technology. It intends to provide skills and knowledge on preparing drawings and sketches of building components.

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

1. Identify the different components of buildings;
2. Follow the steps of construction systematically;
3. Supervise and test on the workmanship and quality of materials to be used in construction and
4. Acquire knowledge and skills on earthquake resistant building construction techniques.

**Course Contents:**

**Theory**

**Unit 1: Introduction to Building Construction: [4 Hrs.]**

1.1 Definition of building and its uses
1.2 Building types
1.3 General components of a building
1.4 Technical terms used in buildings
1.5 General requirements of parts of building
1.6 General rules of Vaastu

**Unit 2: Foundation and its types: [6 Hrs.]**

2.1 Concept of Foundation and its purposes
2.2 Types of Foundation – Shallow and Deep
  2.2.1 Shallow Foundation – Construction Details of spread foundations for walls, thumb rules of depth and width of foundation and thickness of concrete blocks, Stepped foundation, masonry Pillars and concrete columns.
  2.2.2 Deep foundation and its types (introduction only)
2.3 Earthwork
  2.3.1 Layout/setting out for surface excavation, cutting and filing
  2.3.2 Excavation of foundation, trenches, shoring, timbering and de-watering

**Unit 3: Walls: [6 Hrs.]**

3.1 Purpose of walls
3.2 Classification of walls – load bearing, non-load bearing, dwarf wall, retaining, breast walls and partition walls.
3.3 Classification of wall as per materials of construction: brick, stone, reinforced brick, reinforced concrete, precast, hollow and solid concrete block and composite masonry walls.

3.4 Partition wall: Construction details, suitability and uses of brick and wooden partition walls.
3.5 Mortars: types, selection of mortar and its preparation
3.6 Scaffolding, construction details and stability of mason's brick layer and tubular scaffolding, shoring, underpinning

**Unit 4: Brick Masonry: [4 Hrs.]**

4.1 Definition of terms: header, stretcher, queen closer, king closer, frog and quoin, course, bond, facing, backing, hearting, jambs, reveals, soffit, plinth, pillars and pilasters
4.2 Construction of brick walls – methods of laying bricks in walls, precaution observed in the construction of walls, method of bonding new brick works with old (toothing, racking, back and block bonding), Expansion and contraction joints.
4.3 Importance towards special care during execution on: soaking of bricks, maintenance of bonds and plumb, filing of horizontal and vertical joints, masonry work, restriction height of construction on a given day, every fourth course, earthquake resistance measure, making of joints to receive finishes.

**Unit 5: Stone Masonry [4 Hrs.]**

5.1 Glossary of terms- natural bed, bedding planes, string course, corbel, cornice, block in course grouting, moulding, corner stone, bond stone, throughstone, parapet, coping, buttresss
5.2 Types of stone masonry: Rubble masonry- random and coursed, Ashlar masonry, principle to be observed in construction of stone masonry walls
5.3 Importance towards special care and placing of bond and corner stones, filling joints, proper packing of internal cavities of rubble masonry wall, raking of joints to receive finishes.

**Unit 6: Damp and Water Proofing: [5 Hrs.]**

6.1. Dampness and its effects on construction works
6.2. Causes and sources of dampness
6.3. Methods of damp proofing
6.4. Materials used for damp proofing
6.5. Damp proofing treatment in
  6.5.1. Foundation
  6.5.2. Walls
  6.5.3. Floors
  6.5.4. Roofs
  6.5.5. Parapet walls

**Unit 7: Concrete and Concrete Construction: [10 Hrs.]**

7.1. Concrete and grades of concrete
7.2. Properties of concrete
7.3. Methods of proportioning concrete mixes
7.4. Mix design
  7.4.1. Design mix
  7.4.2. Nominal mix
7.5. Concreting processes
  7.5.1. Batching of materials
  7.5.2. Concrete mixing
  7.5.3. Transportation of concrete

7.5.4. Placing of concrete
7.5.5. Compaction of concrete
7.5.6. Curing of concrete
7.6. Concreting under water
7.7. Placing under cold weather
7.8. Placing concrete in hot weather
7.9. Water proofing of concrete
7.10. Steel reinforcement
7.11. Permissible stresses in reinforcement
7.12. Reinforced cement concrete and its characteristics
7.13. Advantages of reinforced cement concrete
7.14. Concreting equipment and accessories
7.15. Causes of failure of reinforced concrete structure

**Unit 8: Formworks: [4 Hrs.]**

8.1. Characteristics of good formwork
8.2. Materials for formwork
8.2.1. Timber formwork
8.2.2. Plywood formwork
8.2.3. Steel formwork
8.3. Construction of formwork
8.3.1 column
8.3.2 Beam and Slab
8.3.3 Stair
8.3.4 wall
8.4. Order and method of removing formwork

**Unit 9: Sill /Lintels and Arches: [2 Hrs.]**

9.1. Sill/Lintels and its uses
9.2. Types of sill/lintels in terms of material used
9.3. Arch and its uses
9.4. Types of arches and materials of construction

**Unit 10: Floors and Floor finishes: [6 Hrs.]**

10.1. Glossary of terms- floor finish, topping, under layer, base course, rubble filing and their purpose
10.2. Types of floor finishes – Cast –in –situ, concrete flooring (monolithic, bonded), Terrazzo tiles flooring, stone (marble and kota) flooring, PVC flooring, Glazed tiles flooring, timber flooring, description with sketches.
10.3. Specials emphasis on level/slope/reverse slope in bathroom, Toilet, kitchen, balcony and staircase

**Unit 11: Stairs and Roofs: [6 Hrs.]**

11.1. Glossary of terms: Staircase, winders, landing, stringer, newel, baluster, riser, tread, width of staircase, hand-rail, nosing
11.2. Classification of staircase on the basis of materials- RCC, Timber, steel, aluminum
11.3. Planning and layout of staircase: Relation between rise and tread, Determination of width of stair, landing etc.
11.4. Various types of layout- straight flight, dog-legged, open well, quarter turn, half turn, bifurcated stair, spiral stair
11.5. Types of roofs, concept of flat, pitched and arched roofs

11.6. Glossary of terms for pitched roofs-batten, eaves, facia board, gable, hip, lap, purlin, rafter, rag bolt, valley, ridge, rain water gutter, anchoring bolts
11.7. False ceilings using gypsum, plaster boards, cellotex, fiber boards

**Unit 12: Doors and Windows: [6 Hrs.]**

12.1. Glossary of terms with neat sketches of doors and windows
12.2. Classification based on materials: wood, metal and plastics and their suitability for different situations. Different types of door- panel door, flush door, flazed door, rolling shutter, steel door, sliding door, UPVC and aluminum doors
12.3. Windows- panel window, glazed windows (fixed and openable) ventilators, sky light window, louvers shutters, and UPVC and aluminum windows
12.4. Door and windows frames: materials and sections, door closures, holdfast

**Unit 13: Finishing Works: [6 Hrs.]**

13.1. Plastering – Classification according to use and finishes like plain plaster, grit finish, rough cast, pebble dashed, concrete and stone cladding etc. Techniques of plastering and curing.
13.2. Pointing- different types of pointing and their methods
13.3. Painting- Preparation of surface, primer coat and application of paints on wooden, steel and plastered wall surfaces.
13.4. Application of white washing, colour washing and distempering, polishing, applications of cement and plastics paints.
13.5. Selection of appropriate paints/ finishes for interior and exterior surfaces

**Unit 14: Miscellaneous Construction Works: [3 Hrs.]**

14.1. Causes and prevention of cracks in buildings
14.2. Methods to prevent termite action
14.3. Maintenance of Existing Building

**Unit 15: Earthquake: [10Hrs.]**

15.1 Concept of earthquake [4 Hrs.]
- 15.1.1 Introduction
- 15.1.2 Terminologies
- 15.1.3 Causes of earthquake
- 15.1.4 Earthquake locations
- 15.1.5 Measurement of Earthquake
  - 15.1.5.1 Earthquake Magnitude
  - 15.1.5.2 Earthquake Intensity
- 15.1.6 Seismicity of Nepal
- 15.1.7 Seismic hazard of Nepal

15.2 Earthquake effect [2Hrs]
- 15.2.1. Ground effects
- 15.2.2 Effects of earthquake on buildings
- 15.2.3. Causes of failure

15.3 Building forms for earthquake resistance [4 Hrs.]
- 15.3.1. Building configuration
- 15.3.2. Height and number of storey
- 15.3.3 Distribution of load bearing elements
- 15.3.4. Location and size of door and window openings
- 15.3.5 Mass and stiffness distribution in buildings

**Unit 16: Building Planning and Building Services [8Hrs.]**

16.1 Site selection: factors to be considered for selection of site for residential, public, commercial and industrials

16.2 Basic principle of building planning and arrangement of doors, and windows for residential building.

16.3 Orientation of building in relation to sun and wind, direction, rains, internal circulation and placement of rooms within the available area.

16.4 planning of building services

16.5 Introduction to National Building code.

16.6 Introduction to firefighting systems, Ducting for Air-conditioning, service, lines for cable telephone, and electrical wiring, garbage disposal systems.

**Laboratory/Practical**

**Unit 1: Laboratory: [15 Hrs.]**

1. Layout building plan:
2. Perform slump test
3. Perform compressive strength test of concrete/Hollow blocks
4. Demonstrate the following items of work at construction site by:
   A. Timbering of excavated trenching
   B. Damp proof coarse laying
   C. Plastering and Pointing exercise
   D. Construction of RCC work

**Textbooks:**


1. Punmia B.C. Dr., *Building Construction* (Latest Edition).
2. Kumar Sushil *Building Construction* (Latest Edition).
3. Sharma S.K. &Kaul B.K., *Building Construction* (Latest Edition).
4. Singh Gurucharan, *Building Planning & Design* (Latest Edition)


**References:**


1. Department of Urban Development, *Nepal Building Code*
2. Arya A.S., *Masonry and Timber Structure including Earth* (Latest Edition)
3. Jain, *Plain Cement Concrete, Vol I & II* (Latest Edition)
4. Kumar Sushil, *Reinforced Concrete Structure* (Latest Edition)
5. Punmia B.C. Dr., *Reinforced Concrete Structure, Vol. I & II* (Latest Edition)
6. IS 4326-1993; Earthquake Resistant Design and Construction of Buildings-Code of Practice, Bureau of Indian Standards, New Delhi, India
7. NBC 108-1994; Site Consideration, Government of Nepal, Ministry of Housing and Physical Planning, Department of Buildings, Nepal, 1995.
8. NBC 109-1994; Masonry: Unreinforced, Government of Nepal, Ministry of Housing and Physical Planning, Department of Buildings, Nepal, 1995.
9. NBC 201-1994; Mandatory Rules of Thumb: Reinforced Concrete Buildings with Masonry Infill, Government of Nepal, Ministry of Housing and Physical Planning, Department of Buildings, Nepal, 1995.
10. NBC 202-1994; Mandatory Rules of Thumb Reinforced Concrete Buildings without Masonry Infill, Government of Nepal, Ministry of Housing and Physical Planning, Department of Buildings, Nepal, 1995.
11. NBC 202-1994; Mandatory Rules of Thumb: Load Bearing Masonry, Government of Nepal, Ministry of Housing and Physical Planning, Department of Buildings, Nepal, 1995.

12. *NSET-Nepal: Earthquakes, A manual for designers and builders,*

**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 to Building Construction | 4 | 2 |
| 2 | Foundation and its types | 6 | 6 |
| 3 | Walls | 6 | 6 |
| 4 | Brick Masonry | 4 | 4 |
| 5 | Stone Masonry | 4 | 4 |
| 6 | Damp and Water Proofing | 5 | 6 |
| 7 | Concrete and Concrete Construction | 10 | 10 |
| 8 | Formworks | 4 | 4 |
| 9 | Sill /Lintels and Arches | 2 | 2 |
| 10 | Floors and Floor finishes | 6 | 4 |
| 11 | Stairs and Roofs | 6 | 6 |
| 12 | Doors and Windows | 6 | 4 |
| 13 | Doors and Windows | 6 | 4 |
| 14 | Miscellaneous Construction Works | 3 | 4 |
| 15 | Earthquake | 10 | 8 |
| 16 | Building Planning and Building Services | 8 | 6 |

* There may be minor deviation in marks distribution.

**Engineering Materials**
**EG 2105 CE**

**Year: II** **Total: 5 Hrs. /week**
**Semester: I** **Lecture: 4 Hrs./week**
**Tutorial: Hrs./week**
**Practical: 1Hrs./week**
**Lab:2/2 Hrs./week**

**Course Description:**
This course is designed to help students on using various construction materials in construction works.

**Course objectives:**
After the completion of this course, students will be able to:

1. Recognize various construction materials that are essential in construction;
2. Select the quality materials for the use in construction;
3. Test materials for quality, strength and durability and
4. Use materials in their proper field and state.

**Course Contents:**

**Theory**

**Unit 1: Stones:** **[7 Hrs.]**

1.1 Introduction to stones as building units
1.2 Stones as various forms of engineering materials
1.3 Formation of rocks and its classification
1.4 Geological classification of stones
1.5 Availability of stones in Nepal
1.6 Physical and Chemical properties of stones
1.7 Quarrying of stones – Excavation, wedging and blasting,
1.8 Blasting of stones – Precautions
1.9 Preparing building units from stones- Dressing and seasoning.
1.10 Testing of stones for-
  1.10.1 Weathering
  1.10.2 Durability,
  1.10.3 Water absorption and porosity,
  1.10.4 Specific gravity,
  1.10.5 Compressive strength
1.11 Characteristics of good building stones.

**Unit2: Bricks** **[8 Hrs.]**

2.1 Introduction
2.2 Classification
2.3 Brick earth: Composition of brick earth, functions of various constituent of brick earth, harmful constituents.
2.4 Preparation of brick earth for making bricks: digging, weathering, blending and tempering.
2.5 Moulding of bricks and various methods of moulding
2.6 Drying of moulded bricks
2.7 Burning of bricks: Intermittent and continuous kilns
2.8 Traditional method of brick burning

2.9 Tests of bricks: Compressive strength, Water absorption and Efflorescence.

**Unit 3: Tiles** **[6 Hrs.]**

3.1Types of tiles: Roofing tiles, wall tiles, clay pipes and uses in construction
3.2Manufacturing of tiles
3.3Properties of tiles

**Unit 4: Lime:** **[6 Hrs.]**

4.1Introduction
4.2Classification of limes: Fat Lime (white lime), Lean lime, and Hydraulic lime.
4.3Setting action of lime
4.4Manufacturing of lime
4.5Raw materials, burning, slaking
4.6Intermittent and continuous methods of manufacture
4.7Testing of Limes: Visual examination test, acid test, ball test, impurity test and working test

**Unit 5: Cement:** **[8 Hrs.]**

5.1 Introduction
5.2 Uses of Cement in Construction
5.3 Raw materials (Ingredients) of Cement
5.4 Wet process of manufacturing
5.5 Flow diagram of wet process of manufacturing
5.6 Various types of cement and their properties
5.7 Storage and transportation
5.8 Various admixtures and bogue compounds
5.9 Standards test on Cement

**Unit 6: Timber and Timber products:** **[10 Hrs.]**

6.1 Introduction
6.2 Definition and sources of timber
6.3 Classification of trees
6.4 Structure of tree, hard wood and soft wood and their characteristics,
6.5 Defects in timber
6.6 Seasoning of Timber, Objectives of Seasoning, Various methods of seasoning, Prevention of drying of logs, Preservation of Timbers,
6.7 Plywood, Lamina Boards, Block boards, Hard boards, Fiber boards

**Unit 7: Metals and Alloys:** **[8 Hrs.]**

7.1 Ferrous and Non-ferrous metals
7.2 Uses of different metals in construction
7.3 Occurrence of Iron: Pig iron
7.4 Properties and uses of:
- Cast iron
- Wrought iron

7.5 Comparison of wrought iron with cast iron in similar headings
7.6 Steel: Composition, properties and uses, different types of steels
7.7 Corrosion in ferrous metals
7.8 Protection of ferrous metals
7.9 Alloys: Aluminium alloys, copper alloys and bronzes: composition, properties and uses.

**Unit 8: Paints and Varnishes:** **[4 Hrs.]**

8.1 Introduction – Paints and Varnishes
8.2 Uses of Paints and Varnishes
8.3 Composition of various types of Paints: Oil paint, Water Paint, Cement paints and Acrylic paints
8.4 Methods of application of various paints

**Unit 9: Miscellaneous Materials:** **[3 Hrs.]**

9.1 Glass (Constituents, types, properties, applications and limitation in use)
9.2 Plaster of Paris
9.3 Insulation Boards
9.4 Prefabricated materials (gypsum board, sandwich panel)

**Practical (Laboratory)** **[15 Hrs.]**

1. Perform fineness test of cement
2. Perform consistency test of cement
3. Determine initial and Final setting time of cement
4. Perform compressive test of cement
5. Perform tensile test of cement

**References:**


1. Bhavikatti, S.S., (2015). Building materials and construction
2. Singh Surendra., (latest edition). Engineering materials, Vikas publishing house pvt.ltd.
3. Chong, C.V.Y., (1977). Properties of materials, MacDonald and evans ltd. estover, plymouth, UK
4. Gupta, R. B., (1974). Material science and processes, Satya prakashan, inc. tech India publication, New Delhi.
5. Sthapit, Chinikaji, (2011/12) Engineering materials, Laxmi pustak Bhandar


**Evaluation Scheme**

| Unit | Chapter | Time (Hrs.) | Marks |
|---|---|---|---|
| 1 | Stones | 7 | 12 |
| 2 | Bricks | 8 | 12 |
| 3 | Tiles | 6 | 8 |
| 4 | Lime | 6 | 12 |
| 5 | Cement | 8 | 16 |
| 6 | Timber and timber products | 10 | 16 |
| 7 | Metals | 8 | 12 |
| 8 | Paints and varnishes | 4 | 8 |
| 9 | Miscellaneous materials | 3 | 4 |
| | Total | 75 | 100 |

**Fourth Semester**
**Subjects:**

| | | |
|---|---|---|
| 1 | EG 2201 SH | Social Engineering |
| 2 | EG 2201 AR | Construction Drawing and CAD |
| 3 | EG 2201 CE | Surveying II |
| 4 | EG 2202 CE | Estimating and Costing I |
| 5 | EG 2203 CE | Mechanics of Structure |
| 6 | EG 2204 CE | Soil Mechanics and Foundation Engineering |
| 7 | EG 2205 CE | Water Supply Engineering |

**Social Engineering**
**EG 2201 SH**

**Year: II** **Total: 2 Hrs. /week**
**Semester: II** **Lecture: 2 Hrs./week**
**Tutorial: Hrs./week**
**Practical: Hrs./week**
**Lab: Hrs./week**

**Course Description:**
The main objective of social engineering course is to introduce about the Nepal in different aspect. This is an integrated course for diploma engineering level students comprising of social, cultural, history, geography, political, economy, religion, moral science subjects in general.

**Course Objectives:**
The diploma engineering students will be familiar in the following topics:
1. Introduce social science and social study
2. Understand economy condition of Nepal
3. Know the social and cultural change in short description
4. Understand the history of engineering
5. Know the professional ethics
6. Introduce briefly to the environment, social service, social development and social research

**Course Contents:**

**Unit 1: Introduction to sociology, social study and social science [5 Hrs]**

1.1. Introduction, scope and importance of social study, community
1.2. Relationship of sociology and social study
1.3. Relation between sociology and social science
1.4. Difference between social study and social science
1.5. Society: meaning, definition and characteristics
1.6. Introduction to sociology and rural sociology
1.7. Interrelation between social science and physical science
1.8. Interrelation between social study and other subjects
1.9. Science and engineering
1.10. Science and technology
1.11. Science and society
1.12. Science and religion
1.13. Applied sociology

**Unit 2: Economy condition of Nepal [3 Hrs]**

2.1. How an economic system functions, The theory of demand and supply
2.2. Importance of trade, Industry, Agriculture, transportation and communication
2.3. Features of economy, agro economy, mixed economy, common economy and phase wise development

**Unit 3: Social and cultural change** **[6 Hrs]**

3.1. Meaning of social and cultural change, Theory of origin of society, Culture: meaning, definition and characteristics
3.2. Social Norms & Values: meaning, definition and characteristics
3.3. Principle of social and cultural change, Theory of social and cultural change cultural values, norms, Discovery, Innovation, Diffusion, Acculturation & Modernization.
3.4. Characteristics of social change, Technology and social change, social movements
3.5. Factors causing social changes, Type of social change
3.6. Impact of Culture Change on Individuals and Communities
3.7. Industrialization and social change
3.8. Influence of technology in rural social life
3.9. Characteristics of industrial and rural society
3.10. Concept of urbanization and urban development

**Unit 4: Introduction of Social development and services** **[4 Hrs]**

4.1. Meaning and objectives of social development project
4.2. Concept of Social development program
4.3. Introduction of Social development and community participation in development activities, types of participation, Important of community participation
4.4. Social service: definition, types, characteristics and objective
4.5. Social worker: definition, types, characteristics and role
4.6. Position of women in society social inclusion

**Unit 5: Concept of Social survey** **[4 Hrs]**

5.1. Definition, characteristics, Methods, types and objectives
5.2. Steps of social survey
5.3. Social report writing: Introduction, definition, purpose, formats

**Unit 6: Ethics and Moral** **[8 Hrs]**

6.1. Definition of Ethics, Concept of ethics, Major religions of the world
6.2. Introduction of Engineering Ethics, Code of ethics
6.3. Introduction of Moral and immoral, Meaning of religion, Major religions of the world
6.4. Definitions of Utilitarianism, Duty Ethics, Right ethics, Virtue Ethics,
6.5. Definitions of Personality Tort, Social Responsibility, Plagiarism &Cheating, Whistleblowing
6.6. Ethic and Engineering
6.7. Ethics and social responsibility, negligence, tort and duty and liability
6.8. Professional Practice in Nepal

**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 to social study and social science | 05 | 6 |
| 2 | Economy condition of Nepal | 03 | 4 |
| 3 | Social and cultural change | 06 | 8 |
| 4 | Introduction of Social development and services | 04 | 6 |
| 5 | Concept of Social survey | 04 | 6 |
| 6 | Ethics and Moral | 08 | 10 |
| Total | | 30 | 40 |

**Textbooks**


1. Rao C. N. Shanker (2005), Sociology, S. Chand, New Delhi
2. Schaefer, Richard T. and Robert P. Lamm (1999), Sociology (6th edition), Tata McGraw-Hill, New Delhi.
3. Dominelli, Lena (1997), Sociology for Social Work, Palgrave, London.


**References**


1. Berger, Peter (1963) An Invitation to Sociology, Anchor Books, New York.
2. Beteille, Andre (2002) Sociology: Essays on approach and Method, OUP, New Delhi.
3. Calhoun, Craig (2002) Dictionary of Social Sciences, OUP, Oxford.
4. Giddens, Anthony (2001) Sociology (4th edition), Polity Press, Cambridge.
5. Dr. Rajendra Adhikari, "Engineering Professional Practice- Nepalese and International Perspectives" Pashupati publishing house, Kathmandu, Nepal
6. Er Santosh Kumar Shrestha and Er Ram Kumar Shrestha 2nd Edition, (Aug2016) "Text book of Engineering Professional Practice" Heritage Publisher and distributors Pvt. Ltd., Kathmandu, Nepal
7. M. Govindarajan, S. Natarajan, V.S. Senthil Kumar, (Jan 2015) "Engineering Ethics includes Human Values", PHI Learning Pvt. Limited, New Delhi-110092,
8. https://resources.saylor.org/wwwresources/archived/site/textbooks/OpenStax%20Sociology.pdf

**Construction Drawing and CAD**
**EG 2201 AR**

**Year: II** **Total: 5 Hrs. /week**
**Semester: II** **Lecture: 1 Hrs./week**
**Tutorial: 0 Hrs./week**
**Practical: 4 Hrs./week**
**Lab: 0 Hrs./week**

**Course Description:**
This course provides students with a broad introduction into 2-dimensional and basic of 3-dimensional Computer-Aided Drawing and Drafting (CADD) with a focus on civil engineering drawings. This course is an intensive introduction to the use of a Computer Aided Design and Drafting (CADD) system for the development of construction drawing and documentation. Moreover, it also intends to impart skills on preparing drawings and sketches of construction details for building construction and construction of other structures and its implementation in field.

**Course Objectives:**
After the completion of this course student will be able to:
1. Introduce CAD software programs (Autodesk Auto CAD) to model construction projects
2. Create basic Civil and Architectural drawings;
3. Prepare setting out drawings for construction activities;
4. Prepare working drawings of different components of earthquake resistant buildings;
5. Prepare working drawing of engineering constructions;
6. Prepare basic 3-d objects;
7. Perform hand drawing.

**Course contents:**

**Theory**

**Unit 1: Introduction to the Construction Drawing and CAD: [2 Hrs.]**
1.1. Overview of the type of drawings (Concept drawing, working drawing, Structural drawing and As-built drawing etc.)
1.2. Introduction to application software (especially CADD, Land Development software) and its installation.
1.3. Computer graphics fundamentals (raster object and vector application) data storage and retrieval, hierarchical storage system, introduction to basic graphical application, drawing exchange.

**Unit 2: Starting a New Drawing/Opening an Existing Drawing: [2 Hrs.]**
2.1. Setting up a drawing, starting from scratch, using a Wizard, using an existing template file and creating a new template file.
2.2. Opening an existing drawing
2.3. Screen layout, pull-down menus, screen icons, command line and dialogue boxes, status bar toggles,
2.4. Setting preferences (Setting Units and Scale, managing drawing area by using MV setup and Limits, setting and use of drafting aids.
2.5. Saving Drawing in different formats (. dwg, dxf, dwt, pdf) and version of files.
2.6. Recovering Unsaved files.

**Unit 3: Drawing Commands: [4 Hrs.]**
3.1. Co-ordinate input methods (absolute, relative, polar, and dynamic)
3.2. Point, Lines, Polyline, Multiline, Construction Lines

3.3. Circle, Arc, Ellipse, Donut
3.4. Polygon, Rectangle, Spline, Solids etc.
3.5. Hatching
3.6. Text (multi-line & single line / true type fonts
3.7. Dimension tools

**Unit 4: Modify Commands: [1 Hr.]**

4.1. Object selection
4.2. Real-time pan and Zoom
4.3. Erase, Trim, Break
4.4. Copy, Cut, Mirror, Offset, Array,
4.5. Move, Rotate, Scale, Stretch,
4.6. Lengthen, Extend,
4.7. Chamfer, Fillet, explode, break at point, joint etc.

**Unit 5: Features: [2 Hrs.]**

5.1. View tools,
5.2. Layers concept, match and change properties.
5.3. measure and divide
5.4. inquiry commands (Id, Distance, Area, List, Mass property etc.
5.5. Working with Block, W-block and External References.
5.6. Drawing Exchange (convert to other format from drawing format and into drawing format)
5.7. Using drawing attributes, uses of predefined objects etc.
5.8. Uses of script files.
5.9. Use of Layout, and viewport to scale object and manage paper space.

**Unit 6: Application of CADD in Civil Engineering Field: [1 Hr.]**

6.1. Land development and surveying,
6.2. CADD and Highway Engineering
6.3. CADD and Building Drawing
6.4. CADD with water supply and sanitary drawings

**Unit 7: Basic use of 3-D modeling in AutoCAD [2 Hrs.]**

7.1. Overview of different 3-D planes and views.
7.2. Switching between 2-D and 3-D mode.
7.3. Changing UCS in 3-D mode.
7.4. Using Basic 3-D commands (Orbit, Extrude, Subtract and Slice)
7.5. Creating Basic 3-D objects (Box, Cylinder, and Cone etc.)
7.6. Creating Simple 3-D objects from 2-D objects (Round Table and extrude wall)

**Unit 8: Plotters and Plotting the Drawing: [1 Hr.]**

**Practical**

**Unit 1: Starting a New Drawing/Opening an existing drawing [2 Hrs.]**

1.1. Set up a drawing starting from scratch, using a Wizard, using and creating a template file, drafting aids.
1.2. Open an existing drawing
1.3. Prepare Screen layout, pull-down menus, screen icons, command line and dialogue boxes, toggles keys, Screen organization.
1.4. Set preferences (Setting Units and Scale, managing drawing area by using MV setup and Limits.)
1.5. Save drawing in different formats (. dwg, dxf, dwt, pdf) and versions of files.

1.6. Recover unsaved files.

**Unit 2: Drawing Commands [5 Hrs.]**

2.1. Draw a rectangle using Co-ordinate input methods (directive, absolute, relative and polar)
2.2. Draw Point, Lines, Polyline, Multiline, Construction Lines
2.3. Draw Circle, Arc, Ellipse, Donut
2.4. Draw Polygon, Rectangle, Spline, solids etc.
2.5. Hatch Objects and areas between lines.
2.6. Write Text (multi-line & single line / true type fonts)
2.7. Give Dimensions to various objects (circle, line, rectangle, polygon etc.) using Dimensions tools.

**Unit 3: Modify Commands [2 Hrs.]**

3.1. Perform various Object selection methods.
3.2. Apply: Erase, Trim, Break tools to modify the existing drawing.
3.3. Apply: Copy, Mirror, Offset, Array tools to modify the existing drawing.
3.4. Apply: Move, Rotate, Scale, stretch tools to modify the existing drawing.
3.5. Apply: lengthen Extend commands to modify the existing drawing.
3.6. Apply: Chamfer, Fillet, explode, and break at point and joint commands to modify the existing drawing.

**Unit 4: Features [3 Hrs.]**

4.1. Create Layers and perform match and change properties.
4.2. Measure line and divide in parts
4.3. Apply Inquiry commands
4.4. Perform Drawing Exchange (convert to the other formats from one drawing format.)
4.5. Use Layout, template and viewport to scale object and manage paper space.

**Unit 5: Hand Drawing and Field Work: [30Hrs.]**

5.1 Prepare drawing plate/plates of a Single Storied R.C.C. building with three or more rooms per floor with reinforced concrete slab meeting the requirements of Nepal Building code (NBC).
5.2 Prepare setting out plans for earth cutting and construction lines of building drawn in task 1 above.
5.3 Practice staking out in the field of the plan prepared on task 2 above.
5.4 Draw detail drawings of:
  5.4.1 Dog legged stair case (RCC)
  5.4.2 Door and Window frames including joints and fixing details
  5.4.3 Flush and panel door including joints and fixing details.
  5.4.4 Casement window including joints and fixing details.
5.5 Prepare a roof plan and elevation with valleys for CGI, and RCC roofing materials including their construction details.
5.6 Draw Racking, Flying and Dead shores with fixing details.
5.7 Draw septic tank and soak pit including sanitary fittings details.

**Unit 6: Application of CADD in Civil Engineering Field [12Hrs.]**

6.1 Draw a complete architectural drawing using CADD software (Location plan, Site plan, Floor plans, Elevations, Sections and detailed structural drawing) of a R.C.C. building, with three or more rooms per floor and two and half storey, following Nepal Building Code (NBC).

**Unit 7: Basic use of 3-D modeling in AutoCAD [5 Hrs.]**

7.1 Make 3-D drawing of a single-room rectangular shaped building with flat slab.

**Unit 8: Plot and change the scale of drawing from model space and also from layout. [1 Hrs.]**

**Textbooks:**

1. Civil Engineering Drawing; Gurcharan Singh, Standard Publishers distributers
2. Mastering AutoCAD 2019 and AutoCAD LT 2019 by George Omura, SYBEX publisher

**References:**

1. Autodesk AutoCAD 2019 Fundamentals by Elise Moss, SDC Publications
2. Sushil Kumar; Building Construction, Standard Publishers Distributers
3. Dr. B.C. Punmia, A.K. Jain, Arun Kr. Jain, Building Construction, Laxmi publication
4. W.B. McKay, Building construction, Vols. I – IV, ELBS, LONGMAN,
5. "Building Drawing with an Integrated Approach to Built Environment" by Shah, Tata McGraw-Hill Education Pvt. Ltd
6. Building Planning and Drawing", S S Bhavikatti and M V Chitawa, I K International Publishing House Pvt. Ltd.

**Minimum Standard:**

1. A well – equipped computer lab.
2. Drawing hall with all necessary tools and infrastructure which includes drawing tables, boards and etc.
3. Setting out tools such as thread, pegs, hammer, level pipe, nails and set square etc.

**Evaluation Scheme**

| S. N. | Chapter | Mark distribution |
|---|---|---|
| **1** | **Hand Drawing and Field work** | **20** |
| 1.1 | Architectural drawing of two storey Building (plans and Elevations / Plans and Sections) | 10 |
| 1.2 | Detail drawing of dog-legged staircase/door and window frames or flush and panel door or casement window, including joints and fixing details | 5 |
| 1.3 | Racking or flying or dead shores with fixing details/septic tank and soak pit including sanitary fitting 5 marks | 5 |
| **2** | **Application of CADD in Civil Engineering Field** | **20** |
| 2.1 | Architectural drawing of two storey Building (plans and Elevations /Plan and Section) | 10 |
| 2.2 | Detail drawing of dog-legged staircase/door and window frames/flush and panel door or casement window, including joints and fixing details | 5 |
| 2.3 | 3-D modeling in AutoCAD for a single room R.C.C. building | 5 |
| | **TOTAL** | **40** |

**Note:**

1. Examination should be conducted on practical basis.
2. Examination should be held in two shifts: each for hand drawing and AutoCAD drawing separately.

**Surveying II**
**EG 2201 CE**

Year: II
Semester: II

Total: 7 Hrs. /week
Lecture: 3 Hrs./week
Tutorial: Hrs./week
Practical: 4 Hrs./week
Lab: Hrs./week

**Course Description**
This course focuses on familiarization of different surveying techniques and equipment. The different surveying techniques include area, volume, coordinate system, and graphical and analytical method of mapping.

**Course Objective**
After the completion of this course, students will be able to:
1. Apply different surveying techniques of civil engineering field;
2. Use modern survey instrument for surveying, constructions and map making procedures.

**Course Content**

**Theory**

**Unit 1: Contouring [8 Hrs.]**
- 1.1 Definition of the terms – Contour line, Contour interval, Horizontal equivalent, Index contour
- 1.2 Characteristics of contour
- 1.3 Criteria for selection of contour interval
- 1.4 Methods of contouring – Direct method, Indirect method (Square method/ Radial method/Tachometric method/Cross section method)
- 1.5 Interpolation of contours (Arithmetic calculation, Graphical method, Estimation method)
- 1.6 Uses of contour maps, Interpretation of typical contours sheets
- 1.7 Field procedures

**Unit 2: Plane Table Surveying [6 Hrs.]**
- 2.1 Principles of plane table surveying
- 2.2 Accessories required in plane table surveying
- 2.3 Working operations of plane table surveying
- 2.4 Orientation – Orientation by magnetic compass, Orientation by back-sighting
- 2.5 Methods of plane table surveying – Radiation method, Intersection method (at least two points)
- 2.6 Introduction of Resection method
- 2.7 Advantages and Disadvantages of plane table surveying

**Unit 3: Theodolite [11 Hrs.]**
- 3.1 Introduction of theodolite
- 3.2 Geometry of theodolite, fundamental lines and planes of theodolites
- 3.3 Uses of theodolite
- 3.4 Classification of theodolite – Transit theodolite, and Non-transit theodolite

3.5 Essentials of theodolite – Telescope, Micrometer screw, Horizontal circle, Vertical circle, Optical plumet, Levelling screws, Bubble tube, Level tube, Upper clamp and Upper tangent screw, Lower clamp and Lower tangent screw
3.6 Working principle of theodolite
3.7 Terminology –Transiting, Swinging the telescope, Changing Face
3.8 Temporary adjustment of theodolite – Setting up of theodolite, Centering, Levelling
3.9 Reading a theodolite - Zero setting, Elimination of parallax, Face left observation, Face right observation
3.10 Measurement of Horizontal angle – Reiteration method, and Mean direction method
3.11 Measurement of Vertical angle and Zenithal angle
3.12 Sources of errors in theodolite survey

**Unit 4: Theodolite Traversing [10 Hrs.]**

4.1 Definition of Traversing, Purpose of Traversing
4.2 Types of Traverse – Closed traverse/Open traverse
4.3 Traverse field works
4.4 Omitted measurements in traverse field works
4.5 Traverse adjustment – computation of angles, angular error, correction of angle, Computation of bearings, Computation of consecutive coordinates, Error in consecutive coordinates (Latitude and Departure), Correction of consecutive coordinates (using Bowditch rule/Transit Rule), and Computation of Independent coordinates, Computation of Adjusted Length and Adjusted Bearing.
4.6 Traverse plotting

**Unit 5: Area and Volume Measurement [10 Hrs.]**

5.1 Area measurement of geometric figures - Triangle, Parallelogram, Trapezium
5.2 Measurement of area from offsets – Mid-ordinate rule, Average ordinate rule, Trapezoidal rule, Simpson's one third rule
5.3 Measurement of area from coordinates
5.4 Measurement of area from cross section
5.5 Measurement of volume from cross section and Longitudinal section (Level section, Two Level section)
5.6 Measurement of volume by Trapezoidal formula, and Prismoidal formula

**Practical (Field works)**

1. Perform Contouring on a sloped ground by indirect method (Grid method) [12 Hrs.]
2. Perform Plane tabling and detailing [08 Hrs.]
3. Carryout Theodolite handling practices [12 Hrs.]
4. Perform Theodolite traversing, computation, plotting of traverse in grid sheet [20 Hrs.]
5. Perform measurement of area of a plot [08 Hrs.]

**Evaluation of Practical:** Continuous evaluation (Viva + Instrumentation + Objective test)

**Textbooks:**

1. R. Agor, "Surveying and Leveling", Khanna Publication New Delhi.
2. Dhakal B.B. and Karki B.K., "Engineering Surveying I &II", Heritage Publishers and Distributers Pvt. Ltd., Kathmandu, Nepal.

**References:**


1. N Basnet and M Basnet, "Basic Surveying – I & II", Benchmark Education Support Pvt. Ltd., Tinkune Kathmandu and Rajmati Press, Lalitpur.
2. S K Duggal, "Surveying" Vol I and II, Tata MC Graw Hill Publishing.
3. Dr. B. C Punmia, " Surveying " Vol I and II, Laxmi Publication New Delhi


**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 | Contouring | 08 | 12 |
| 2 | Plane Table | 06 | 08 |
| 3 | Theodolite | 11 | 20 |
| 4 | Theodolite Traversing | 10 | 20 |
| 5 | Area and Volume Measurement | 10 | 20 |
| | **Total** | **45** | **80** |

* **There may be minor deviation in marks distribution.**

**Estimating and Costing I**
**EG 2202 CE**

**Year: II** **Total: 7 Hrs. /week**
**Semester: II** **Lecture: 3 Hrs./week**
**Tutorial: 3 Hrs./week**
**Practical: 1 Hrs./week**
**Lab: Hrs./week**

**Course Description:**
This course focuses on familiarization of estimating and costing of building works.

**Course Objectives:**
After the completion of this course, students will be able to:
1. Understand the estimated cost, actual cost and types of estimation;
2. Understand the procedures methods of measuring and quantifying the building works and
3. Prepare the estimating the cost of building works.

**Course Contents:**

**Theory**

**Unit 1: Introduction** **[5 Hrs.]**
- 1.1 Definition of Estimating
- 1.2 Purpose of Estimating
- 1.3 Estimate versus Actual cost
- 1.4 Administrative approval
- 1.5 Technical sanction
- 1.6 Capital cost
- 1.7 District Rates
- 1.8 Abstract of cost
- 1.9 Bill of quantities
- 1.10 Contingency
- 1.11 Plinth area
- 1.12 Carpet area
- 1.13 Work charged establishment

**Unit 2: Types of Estimates:** **[6 Hrs.]**
- 2.1 Approximate estimate
- 2.2 Detailed estimate
- 2.3 Revised estimate
- 2.4 Supplementary estimate
- 2.5 Annual repair and maintenance estimate
- 2.6 Extension and improvement estimate
- 2.7 Split up of the cost of building work
- 2.8 Internal Electrification, Sanitary and Water Supply works

**Unit 3: Estimation of Building** **[26 Hrs.]**
- 3.1. Data required for preparation of detailed estimate
- 3.2. Principle of units of measurement
- 3.3. Units of measurement and payment for Earthwork, Concrete Work, Soling, Damp Proof Course, Masonry Works
- 3.4. Limits of measurement and degree of accuracy

3.5. Methods of estimate of building works
3.6. Long wall and Short wall method
3.7. Centre Line method
3.8. Estimating quantities of materials in Building works (One Room, Two Room Building)
3.9. Earthwork in excavation and filling
3.10. Brickwork (Foundation and Super Structure)
3.11. Stone works
3.12. Plastering and Painting works
3.13. PCC
3.14. RCC
3.15. Metal works

**Unit 4: Analysis of Rates** **[8 Hrs.]**

4.1. Introduction
4.2. Purpose of analysis of rates
4.3. Requirements of rate
4.4. Factor affecting analysis of rates
4.5. Importance of rate analysis
4.6. Terms used in analysis of rates- Overhead cost, Task or out turn work, Labour rate, Material rate, Through rate
4.7. Government procedure of preparing analysis of rates for building works

**Tutorial** **[45 Hrs.]**

**Taking out detailed quantities and prepare the estimate for the following:**

1. Estimate of a 9" thick wall
2. Estimate one room building with RCC flat roof
3. Estimate one room building (having verandah) with RCC flat roof
4. Estimate steel reinforcement of footing, RCC beam, column and slab
5. Estimate brick masonry retaining walls
6. Estimate steel tubular truss and purlins
7. Estimate dog legged staircase
8. Determine approximate quantities of materials and labour for building based on CBRI, Roorkee
9. Perform computerized estimation of quantities of building work
10. Field visit of an under-construction building

**References:**


1. Amarjit Aggarwal "Civil estimating quantity surveying and valuation" Katson Publishing House, Ludhiyana, 1985
2. P.K. Guha "Quantity Surveying" (Principles and application Khanna Publishers


**Evaluation Scheme**

| Unit | Title | Hrs. | Marks Distribution |
|---|---|---|---|
| 1 | Introduction | 5 | 8 |
| 2 | Types of Estimate | 6 | 12 |
| 3 | Estimation of Building | 26 | 44 |
| 4 | Analysis of Rates | 8 | 16 |
| | | **45 Hrs.** | **80** |

**Mechanics of Structure**
**EG 2203 CE**

**Year: II** **Total: 6 Hrs. /week**
**Semester: II** **Lecture: 4 Hrs./week**
**Tutorial: 1 Hrs./week**
**Practical: Hrs./week**
**Lab: 2/2 Hrs./week**

**Course Description:**
This course is about structural analysis of statically determinate structures and properties of some materials used in structure. It is requisite for design of simple structures.

**Course Objectives:**
After the completion of this course, students will be able to:
1. Identify stable and unstable and statically determinate and indeterminate structures;
2. Determine degree of static indeterminacy of statically indeterminate structures
3. Understand constitutive relation of some materials to be used in structures;
4. Analyze the simple determinate structures like truss, beam and frame, and
5. Analyze shaft and strut for torsion and axial load.

**Course Contents:**

**Theory**

**Unit 1: Introduction:** **[4 Hrs.]**
- 1.1 Definition of mechanics of structure.
- 1.2 Review on types of loads, types of supports and reaction. Their symbolic representation.
- 1.3 Stability, determinacy, indeterminacy and degree of freedom of structure (beam, frame and truss)
- 1.4 Introduction to statically determinate and indeterminate structures
- 1.5 Determination of degrees of static indeterminacies.

**Unit 2: Simple Stress and Strain:** **[14 Hrs.]**
- 2.1 Concepts of stress and strain
- 2.2 Linear stress and strain and their relation, Hooke's law and Young's modulus of elasticity.
- 2.3 Deformation of uniform bar due to axial load
- 2.4 Stress strain curves for different materials.
- 2.5 Ultimate strength and working stress of materials and factor of safety.
- 2.6 Factors affecting factor of safety.
- 2.7 Thermal stress.
- 2.8 Stress and strains in plain and composite bars.
- 2.9 Poisson's ratio, Shear stress, shear strain and modulus of rigidity.
- 2.10 Volumetric strain and Bulk modulus.
- 2.11 Relation between Young's modulus, Bulk modulus and modulus of rigidity.
- 2.12 Concept of Principle stresses, principle planes and shear stress

**Unit 3: Axial force, Shearing force and Bending moment:** **[12 Hrs.]**
- 3.1 Review of Axial force, shear force and bending moment
- 3.2 Axial force, shear force and bending moment diagrams for statically determinate Beam under various types of loading.

3.3 Axial force, shear force and bending moment diagrams for statically determinate Plane frame under various types of loading.
3.4 Point of contra flexure.
3.5 Axial force analysis for statically determinate truss

**Unit 4: Theory of Simple Bending: [10 Hrs.]**

4.1 Concept of bending and pure bending.
4.2 Assumptions in theory of simple bending.
4.3 Radius of curvature, neutral layer and neutral axis.
4.4 Stress due to bending.
4.5 Moment of resistance.
4.6 Derivation of flexural formula (Relation between bending stress, Radius of curvature and moment of resistance)
4.7 Shearing stress in beams.
4.8 Distribution of shear stress in rectangular cross section of beam.
4.9 Determination of bending stress for simple beams
4.10 Section modulus.

**Unit 5: Deflection of beams [6 Hrs.]**

5.1 Definition of elastic curve, slope and deflection of beam.
5.2 Differential equation of elastic curve.
5.3 Deflection of simply supported and cantilever beams.

**Unit 6: Torsion: [6 Hrs.]**

6.1 Introduction.
6.2 Definition of torque and angle of twist.
6.3 Stress due to torsion.
6.4 Derivation of torsional equation.
6.5 Strength of solid and hollow circular shaft.
6.6 Power transmitted by shaft.

**Unit 7: Simple Strut Theory: [8 Hrs.]**

7.1 Definition of column and strut.
7.2 Stability of columns
7.3 End conditions and their effects.
7.4 Derivation of Euler's formula for columns for different types of end conditions
7.5 Effective height and Slenderness ratio.
7.6 Introduction to eccentrically loaded column.

**Tutorial**

**Unit 1: Introduction: [1 Hr.]**

1.1 Differentiate statically determinate and indeterminate structures
1.2 Determine of degrees of static indeterminacies.

**Unit 2: Simple Stress and Strain: [4 Hrs.]**

2.1 Calculate deformation of uniform bar due to axial load
2.2 Draw stress strain curves for different materials and find out ultimate strength, yield strength and working stress.
2.3 Calculate stress and strains in plain and composite bars due to external and thermal loading.
2.4 Calculate poisson's ratio, Shear stress, shear strain and modulus of rigidity.

2.5 Calculate volumetric strain and Bulk modulus.

**Unit 3: Axial force, Shearing force and Bending moment: [4 Hrs.]**

3.1 Draw axial force, shear force and bending moment diagrams for Beam and Frame.
3.2 Determine location of point of contra flexure.

**Unit 4: Theory of Simple Bending: [2 Hrs.]**

4.1 Evaluate radius of curvature, neutral, bending stress and draw stress diagram.
4.2 Calculate moment of resistance and section modulus.

**Unit 5: Deflection of beams: [1 Hr.]**

5.1 Determine deflection of simply supported and cantilever beams.

**Unit 6: Torsion: [1 Hr.]**

6.1 Determine stress in solid and hollow circular shaft.
6.2 Determine strength of solid and hollow circular shaft.
6.3 Evaluate power transmitted by shaft.

**Unit 7: Simple Strut Theory: [2 Hrs.]**

7.1 Determine critical load for different types of columns and strut.

**Practical (Laboratory)**

1 Determine Young's modulus, yield stress and ultimate strength of mild steel specimen (Stress-strain curve)
2 Measure strain and determine force in members of a plane truss
3 Measure deflection of simple beams
4 Determine buckling load of different types of columns

**Textbooks:**

1. G B Motra, "A text book of strength of materials", Publisher .....
2. R.K. Rajput "Strength of Materials", .....

**References:**

1. Surendra Singh "Strength of materials" S. K. Kkataria and sons.
2. Ferdinand P. Beer E Russell Johnston "Mechanics of Materials", Mcgrow hill Book Company.

**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 | 04 | 04 |
| 2 | Simple Stress and Strain | 14 | 20 |
| 3 | Axial force, Shearing force and Bending moment | 12 | 16 |
| 4 | Theory of Simple Bending | 10 | 14 |
| 5 | Deflection of beams | 06 | 08 |
| 6 | Torsion | 06 | 08 |
| 7 | Simple Strut Theory | 08 | 10 |
| **Total** | | 60 | 80 |

* There may be minor deviation in marks distribution.

**Soil Mechanics and Foundation Engineering**
**EG 2204 CE**

**Year: II** **Total: 7 Hrs. /week**
**Semester: II** **Lecture: 4 Hrs./week**
**Tutorial: 2 Hrs./week**
**Practical: Hrs./week**
**Lab: 2/2 Hrs./week**

**Course Description:**
This course is intended to give student a brief introduction to the field of soil mechanics & Foundation Engineering and use of the basic data for analyzing various soil problems common to the civil engineering.

**Course Objectives:**
After the completion of this course, students will be able to:
1. Understand the fundamental and relevant principles of soil mechanics and Foundation Engineering
2. Have an overall picture of the behavior of soil
3. Describe the nature of some of the soil problems encountered in civil engineering and
4. Formulate the basic technique and to develop the methodologies to solve the soil problem.

**Course Contents:**

**Theory**

**Unit 1:Introduction:** **[2 Hrs.]**
- 1.1 Definition of soil
- 1.2 Soil mechanics
- 1.3 Importance of soil mechanics
- 1.4 Origin of soil, Formation of soil, transportation of soils

**Unit 2:Basic Terminology and Interrelations:** **[4 Hrs.]**
- 2.1 Introduction
- 2.2 Phase diagrams
- 2.3 Void ratio, porosity, degree of saturation, unit weight, density, air content and percentage air voids
- 2.4 Interrelations

**Unit 3:Index properties of Soil:** **[6 Hrs.]**
- 3.1 Introduction
- 3.2 Specific gravity
- 3.3 Water content
- 3.4 Particle size distribution
- 3.5 Consistency of soils
- 3.6 Determination of field density

**Unit 4:Soil Classification:** **[6 Hrs.]**
- 4.1 Purpose of soil classification
- 4.2 M.I.T classification system
- 4.3 Textural soil classification
- 4.4 Unified soil classification system
- 4.5 Field identification of soil

**Unit 5:Soil Water and Effective Stress** **[9 Hrs.]**
- 5.1 Types of soil water

5.2 Water table
5.3 Permeability, factors affecting permeability of soil
5.4 Seepage through soils
5.5 Darcy's Law
5.6 Determination of coefficient of permeability: laboratory methods
5.7 Principle of effective stress
5.8 Quick sand condition
5.9 Approximate stress distribution method for loaded areas

**Unit 6:Compaction: [4 Hrs.]**

6.1 Introduction, purposes of compaction
6.2 Standard proctor test
6.3 Field compaction methods
6.4 Factors affecting compaction
6.5 Compaction control

**Unit 7:Consolidation: [9 Hrs.]**

7.1 Introduction, difference between consolidation and compaction
7.2 Primary and secondary consolidation
7.3 Settlement
7.4 Terzaghi's spring analogy
7.5 The standard one-dimensional consolidation test
7.6 Pressure-void ratio curves
7.7 Define co-efficient of compressibility
7.8 Define co-efficient of volume change
7.9 Expression to obtain consolidation settlement

**Unit 8:Shear Strength of Soils: [6 Hrs.]**

8.1 Introduction
8.2 Principle plane and principle stress
8.3 Mohr's circle for two-dimensional stress system
8.4 Mohr-Coulomb failure theory
8.5 Determination of shear strength parameter
8.6 Direct shear test
8.7 Unconfined compression test

**Unit 9:Earth Pressure Theory: [5 Hrs.]**

9.1 Introduction
9.2 Different types of lateral earth pressures
9.3 Introduction to Rankine's earth pressure theory (Active and passive earth pressure in cohesive and cohesionless soil)
9.4 Types of retaining walls
9.5 Principles of the design of retaining walls

**Unit 10: Bearing Capacity: [9 Hrs.]**

10.1 Introduction
10.2 Types of foundation
10.3 Basic definition
10.4 Gross and net foundation pressure
10.5 Terzaghi's bearing capacity theory
10.6 Bearing capacity of footing with finite dimensions
10.7 Effect of water table on bearing capacity
10.8 Settlement of foundation

**Tutorials**

Unit 2: Basic terms and Interrelationship [10 Hrs.]
Unit 3: Particle size distribution and consistency Index [1 Hrs.]
Unit 5: Determination of Coefficient of permeability and effective stress [5 Hrs.]
Unit 6: Calculation of Dry density, moisture content, plotting of compaction curve [3 Hrs.]
Unit 7: Coefficient of compressibility and volume change [1 Hr.]
Unit 8: Mohr column failure theory [3 Hrs.]
Unit 9: Determination of Active earth and passive earth pressure by Rankine's earth pressure theory [4 Hrs.]
Unit 10: Determination of Bearing capacity based on Terzaghis' bearing capacity theory [3 Hrs.]

**Practical (Laboratory)**

1. Perform sieve analysis of Coarse-grained soil (1 session)
2. Determine specific gravity by Pycnometer method (1 session)
3. Determine liquid limit and plastic limit (1 session)
4. Determine field density by Sand replacement method and Core cutter method (1 session)
5. Perform compaction test: Standard proctor test (1 session)
6. Perform direct shear test (1 session)
7. Perform unconfined compression test (1 session)

**Text books:**

1. K.R Arora, "*Soil Mechanics and Foundation Engineering*", Standard Publishers Distributors, Nai-sarak, New Delhi

**References:**

1. V.N.S Murthy "*A Text Book of Soil Mechanics and Foundation Engineering* in *SI Units* "UBS Distributors Ltd. New Edition
2. Prof.T. N Ramamurthy, Prof.T. G Sitaram "*Geotechnical Engineering, Soil Mechanics"* S. Chand Publishing, New Delhi, New Edition.
3. Dr. Sehgal "A text book of soil mechanics" S.B CBS Publishers and Distributors, New Delhi, New Edition
4. Prof. Dr. Ramakrishna Poudel, Asst. Prof Ramesh Neupane "A Text book of soil mechanics", M.E. Nepal Pvt. Ltd, Kathmandu

**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+T) | Marks Distribution |
|---|---|---|---|
| 1 | Introduction | 2 | 2 |
| 2 | Basic terminology and interrelations | 14 | 12 |
| 3 | Index Properties of soil | 7 | 6 |
| 4 | Soil classification | 6 | 6 |
| 5 | Soil water and effective stress | 14 | 12 |
| 6 | Compaction | 7 | 6 |
| 7 | Consolidation | 10 | 8 |
| 8 | Shear strength of soils | 9 | 8 |
| 9 | Earth pressure theory | 9 | 8 |
| 10 | Bearing capacity | 12 | 12 |
| | **Total** | **90** | **80** |

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

**Water Supply Engineering**
**EG 2205 CE**

**Year: II** **Total: 6 Hrs. /week**
**Semester: II** **Lecture: 4 Hrs. /week**
**Tutorial: 1 Hr./week**
**Practical: Hrs./week**
**Lab:2/2 Hrs./week**

**Course Description:**
This course focuses on familiarization of fundamental of water supply engineering terminology, principle, system management, different component of w/s design and construction.

**Course Objectives:**
After the completion of this course, students will be able to:
1. Assess the various water consumption categories;
2. Describe the sources and methods of water collection;
3. Explain and illustrate water transmission and distribution systems;
4. Describe and illustrate pipe fittings, valves accessories and layout;
5. Carry out qualitative and quantitative analysis of water;
6. Explain the process of the water treatment
7. Outline and sketch the water treatment process.

**Course Contents:**

**Theory**

**Unit 1:Water supply:** **[3 Hrs.]**
- 1.1 Introduction
- 1.2 Importance and necessity of planned water supply system
- 1.3 History of planned water supply system in Nepal
- 1.4 Impact of water supply
  - 1.4.1 Positive Impact-long term and short-term impact
  - 1.4.2 Negative Impact
- 1.5 Water supply and its impact on public health, women, and environment
- 1.6 Components of water supply system (Rural and Urban) and their function

**Unit 2:Sources of Water Supply:** **[6 Hrs.]**
- 2.1 Hydrological Cycle and sources of water
- 2.2 Surface Sources: River, Streams, Pond, Lake, Impounded reservoir
- 2.3 Ground Sources: Springs – gravity and artesian, Wells – shallow, deep, artesian and tube wells, Infiltration galleries and wells
- 2.4 Introduction to alternative Sources of water: Rain Water Harvesting, Conservation Pond, fog collection
- 2.5 Conservation and protection of water sources
- 2.6 Selection and measurement of water sources

**Unit 3:Quantity of Water:** **[6 Hrs.]**
- 3.1 Water demand:
  - 3.2.1 Domestic demand
  - 3.2.2 Livestock demand
  - 3.3.3 Commercial demand
  - 3.3.4 Public/municipal demand

3.3.5 Industrial demand
3.3.6 Firefighting demand
3.3.7 Loss and wastage
3.3.8 Total water demand

3.2 Water supply project: Definition, Design period, factors affecting design period, project selection criteria

3.3 Population forecasting: necessity and methods
3.4.1 Arithmetical increase method
3.4.2 Geometrical increase method
3.4.3 Incremental increase method
3.4.4 Numerical on population forecasting and water demands

3.4 Variation in demand of water: types of variation, average demand, peak demand, peak factor, factors affecting demand of water, socio-economic factors affecting demand of water

**Unit 4: Intake: [4 Hrs.]**

4.1. Definition and Classification of intake
4.2. Characteristics
4.4.1 River intake
4.4.2 Reservoir intake
4.4.3 Spring Intake
4.3. Site selection and protection measures for intake works

**Unit 5: Quality of Water: [6 Hrs.]**

5.1. Pure and impure water
5.2. Potable and wholesome water
5.3. Polluted and contaminated water
5.4. Impurities in water: classification and effects
5.4.1 Suspended impurities
5.4.2 Colloidal impurities
5.4.3 Dissolved impurities
5.5. Hardness in water, types of hardness, alkalinity in water
5.6. Living organisms in water: virus, algae, worms and bacteria
5.7. Water related diseases: water borne, water washed, water based and water vector, transmission routes and preventive measures
5.8. Water quality standard for drinking purpose (WHO, GoN)
5.9. Water sampling and storing
5.10. Physical analysis (temperature, colour, turbidity, taste and odour)
5.11. Chemical analysis (total solids, pH, chlorine)

**Unit 6: Treatment of Water: [16 Hrs.]**

6.1. Objectives of water treatment
6.2. Screening: -Purpose, coarse and fine screens
6.3. Plain Sedimentation: - purpose, types of sedimentation tank, ideal sedimentation tank
6.4. Sedimentation with coagulation
6.4.1 Purpose
6.4.2 Process
6.4.3 Coagulants (types and their chemical reactions)
6.4.4 Flocculation tanks

6.4.5 Clarifier

6.5. Filtration
- 6.5.1 Purpose
- 6.5.2 Theory of filtration
- 6.5.3 Types of filters and its operation and maintenance
  - 6.5.3.1 Slow sand filter
  - 6.5.3.2 Rapid sand filter
  - 6.5.3.3 Pressure filter

6.6. Disinfection: purpose, methods of disinfection-boiling, ultra violet ray, ozone treatment, electro catadyne, sodish.

6.7. Chlorination: chlorine dose, residual chlorine, contact time, forms of chlorination - plain chlorination, break point chlorination, super chlorination and de-chlorination, factors affecting chlorination

6.8. Softening: purpose, removal of temporary hardness by boiling and lime treatment, removal of permanent hardness by lime soda, zeolite process

6.9. Miscellaneous treatments: aeration methods, removal of iron and manganese, domestic purification process

**Unit 7:Reservoirs and Distribution System: [4 Hrs.]**

7.1. Water storage (Reservoir): clear water reservoir, service reservoir

7.2. Distribution system: gravity, pumping, and dual system

7.3. Introduction to Ferrocement tank

7.4. Layout of distribution system: dead end, grid iron, ring and radial system

7.5. System of supply: continuous and intermittent system

**Unit 8:Gravity Water Supply System: [4 Hrs.]**

8.1. Concept of gravity water supply

8.2. Schematic diagram of a typical gravity water supply system

8.3. Hydraulic grade line

8.4. Break pressure tank

8.5. Public tap stand post

8.6. Residual head requirement

8.7. Numerical examples of pipeline design

**Unit 9:Conveyance of Water: [4 Hrs.]**

9.1. Types of pipe: CI, GI, steel, PVC, polythene, PPR pipes

9.2. Laying procedure of pipes

9.3. Pipe joints–Purpose, Types-socket and spigot, flanged, expansion, collar and screwed socket joints

9.4. Testing of pipe joints (leakage test)

**Unit 10: Valves and Fittings: [4 Hrs.]**

10.1. Valves- Purpose, Types-sluice, reflux, air and drain valves, Meter, Globe, Ball, Safety, Gate.

10.2. Fittings-Purpose, Types-stop cocks, water taps, bends, reducers, tees, socket, elbow, union, cross, wash basin, shower, sink

10.3. Operation and Maintenance-Necessity, Methods-regular and emergency.

**Unit 11: Water supply in Emergency Situation:** **[3 Hrs.]**

11.1. Introduction: Sphere Guidelines
11.2. Quantity of water required in emergencies
11.3. Cleaning and disinfecting water sources, tanker, pot/utensils
11.4. Rehabilitation of small-scale piped water distribution systems, water treatment works after an emergency
11.5. Emergency treatment of drinking-water at the point of use

**Tutorials:** **[15 Hrs.]**

1. **Introduction** **[1 Hr.]**
   Schematic diagrams of typical Urban and Rural water supply systems

2. **Quantity of Water** **[4 Hrs.]**
   Numerical on population forecasting by Arithmetical increase Method, Geometrical increase Method, incremental increase Method, Numerical on determination of water demands of a community

3. **Intakes** **[1 Hr.]**
   Typical figures of River, Reservoir and spring intakes

4. **Treatment of water** **[3 Hrs.]**
   Typical figure of sedimentation tank, Filtration-slow and rapid sand filter

5. **Reservoirs and Distribution System** **[1 Hr.]**
   Layout of distribution system: dead end, grid iron, ring and radial system, ferrocement tank

6. **Gravity Water Supply System:** **[3 Hrs.]**
   Schematic diagram of a typical gravity water supply system, Break pressure tank Public tap stand post, Numerical examples of Pipeline design

7. **Conveyance of Water** **[1 Hr.]**
   Typical figures of pipe joints

8. **Valves and Fittings** **[1 Hr.]**
   Typical figures of valves

**Practical**

1. Determine physical parameters (Colour, Turbidity, Temperature)
2. Determine pH value
3. Perform jar test
4. Determine total solids
5. Determine dissolved oxygen

**Text books:**

1. S.K. Neupane, *"Water Supply Engineering*", Bhunipuran Prakashan, Bagbazar, Kathmandu.

**References:**

1. Birdie, G.S. and Birdie, J.S, Water Supply and Sanitary Engineering, Dhanapat Rai & Sons Publishers, NaiSarak, Delhi- 110006, India.

2. Dr. Punmia B C, Jain A, and Jain, A, Water Supply Engineering, Laxmi Publications (P) Ltd, New Delhi
3. Barry, R, The Construction of Building (Volume 4) Building Services, Affiliated East- west Press Pvt. Ltd., New Delhi

**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. | Marks distribution* |
|---|---|---|---|
| 1 | Water supply | 4 | 4 |
| 2 | Sources of Water Supply | 6 | 8 |
| 3 | Quantity of Water | 10 | 12 |
| 4 | Intake | 5 | 4 |
| 5 | Quality of Water | 6 | 8 |
| 6 | Treatment of Water | 19 | 20 |
| 7 | Reservoir and Distribution System | 5 | 4 |
| 8 | Gravity Water Supply System | 7 | 8 |
| 9 | Conveyance of Water | 5 | 4 |
| 10 | Valves and Fittings | 5 | 4 |
| 11 | Water supply in Emergency Situation | 3 | 4 |
| | | 75 | 80 |

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

**Third Year**
**(Fifth and Sixth Semesters)**

**Fifth Semester**
**Subjects:**

| | | |
|---|---|---|
| 1 | EG 3101 CE | Surveying III |
| 2 | EG 3102 CE | Estimating and Costing II |
| 3 | EG 3103 CE | Design of Reinforced Concrete (RC) Structures |
| 4 | EG 3104 CE | Transportation Engineering I |
| 5 | EG 3105 CE | Sanitary Engineering |
| 6 | EG 3106 CE | Construction Management |
| 7 | EG 3107CE | Design of Steel and Timber Structure |

**Surveying III**
**EG 3101 CE**

**Year: III** **Total: 7 Hrs. /week**
**Semester: I** **Lecture: 3 Hrs./week**
**Tutorial: Hr./week**
**Practical: 4 Hrs./week**
**Lab: Hrs./week**

**Course Description**
This course focuses on familiarization of different surveying techniques and equipment. The different surveying techniques include computation, and setting out of curves, optical and electronic distance measurement.

**Course Objectives**
After completion of this course students will able to:
1. Apply different techniques of civil engineering survey;
2. Perform traverse survey, detailing, heightening, curves design, and layout techniques and
3. Carryout building layout techniques.

**Course Content**

**Theory**

**Unit 1: Trigonometric Leveling [6 Hrs.]**

1.1 Observation for heights and distances – Base of the object accessible
1.2 Observation for heights and distances – Base of the object inaccessible: instrument stations and elevated object are in the same vertical plane, instrument axes at different level
1.3 Observation for heights and distances – Base of the object inaccessible: Instrument stations and elevated object are in the same vertical plane, Instrument axes at very different level
1.4 Observation for heights and distances – Base of the object inaccessible: instrument stations and elevated object are not in the same vertical plane

**Unit 2: Tachometry Surveying [8 Hrs.]**

2.1 Introduction to tachometry
2.2 Instrument used in tachometry
2.3 System of tachometric measurements – Stadia system, Tangential System, and Subtense Bar System
2.4 Stadia method - Principle of Stadia method, Distance and elevation formula For horizontal line of sight and inclined line of sight with staff vertical
2.5 Determination of instrumental constants K and C
2.6 Tangential method - Distance and elevation formula for different cases: Both angles are angles of elevation, both angles are angles of depression, One angle of elevation and other angle of depression
2.7 Stadia field procedures
2.8 Errors in stadia tachometry

**Unit 3: Horizontal Curve** **[8 Hrs.]**

3.1 Classification of horizontal curves – Simple circular curve, Compound curve, Reverse curve, Transition curve, Combined curve
3.2 Designation of curves – Arc definition, and Chord definition
3.3 Elements of simple circular curve – Tangent length, Length of the curve, Length of long chord, Apex distance, Mid-ordinate
3.4 Setting out of simple circular curve by linear method – offsets from the long chord, perpendicular offset from tangent, Radial offset from tangent
3.5 Setting out of simple circular curve by angular method - Rankine's method of deflection angle, Two theodolite method

**Unit 4: Vertical Curve** **[7 Hrs.]**

4.1 Introduction to vertical curve, Gradient, Rate of change of grade, Length of vertical curves
4.2 Types of vertical curves – Summit curve, and Valley or Sag curve
4.3 Total change of grade
4.4 Computation and setting out of vertical curves - Tangent correction method, and Parabolic equation method

**Unit 5: Transition Curve** **[4 Hrs.]**

5.1 Introduction to transition curve
5.2 Use of transition curve
5.3 Notation and Elements of combined curve (circular and transition curve)

**Unit 6: Total Station Surveying** **[6 Hrs.]**

6.1 Introduction of Total station
6.2 Features of Total station
6.3 Electronic data recording
6.4 Field surveying procedure of Total station

**Unit 7: Geographic Information System (GIS)** **[2 Hrs.]**

7.1 Introduction of GIS
7.2 Application of GIS in civil engineering projects

**Unit 8: Global Positioning System (GPS)** **[2 Hrs.]**

8.1 Introduction to GPS
8.2 Components of GPS
8.3 Working principle and uses of GPS

**Unit 9: Construction Surveying** **[2 Hrs.]**

9.1 Four room Building layout – Linear method (3,4, 5 method) and Angular method
9.2 Setting out of a sewer line at plain and sloping ground

**Practical (Field Works)**

1. Perform the trigonometric leveling for determination of height and distance (base of the object accessible and inaccessible cases) [8 Hrs.]
2. Perform the tachometric surveying (Topographic map) by stadia method, and tangential method [12 Hrs.]
3. Set out simple circular curve by linear and angular method [16 Hrs.]
4. Set out simple building by linear and angular method [8 Hrs.]
5. Set out of a sewer line at plain and sloping ground [8 Hrs.]
6. Demonstrate Total Station and GPS [8 Hrs.]

**Evaluation of Practical:** Continuous evaluation (Viva + Instrumentation + Objective test)

**Textbooks:**


1. R Agor, "Surveying and Leveling", Khanna Publication New Delhi.
2. Dhakal B.B. and Karki B.K., "Engineering Surveying I &II", Heritage Publishers and Distributers Pvt. Ltd., Kathmandu, Nepal.


**References:**


1. N Basnet and M Basnet, "Basic Surveying – I & II", Benchmark Education Support Pvt. Ltd., Tinkune Kathmandu and Rajmati Press, Lalitpur.
2. S K Duggal, "Surveying" Vol I and II, Tata MC Graw Hill Publishing.
3. Dr. B. C Punmia, " Surveying " Vol I and II, Laxmi Publication New Delhi


**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 | Trigonometric Leveling | 06 | 08 |
| 2 | Tachometry Surveying | 08 | 16 |
| 3 | Horizontal Curve | 08 | 16 |
| 4 | Vertical Curve | 07 | 12 |
| 5 | Transition Curve | 04 | 08 |
| 6 | Total Station | 06 | 08 |
| 7 | Geographic Information System (GIS) | 02 | 04 |
| 8 | Global Positioning System (GPS) | 02 | 04 |
| 9 | Construction Surveying | 02 | 04 |
| | **Total** | **45** | **80** |

* There may be minor deviation in marks distribution.

**Estimating and Costing II**
**EG 3102 CE**

**Year: III** **Total: 6 Hrs. /week**
**Semester: I** **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 and specifications of road works and water supply and sanitary works and valuation of existing property.

**Course Objectives:**
On completion of this course the student will be able to:
1. Understand the procedures, methods of measuring and quantifying the road and restoration work;
2. Calculate the quantities of earthwork of road in plan and hilly area;
3. Analyze rate of road and water supply and sanitations works;
4. Provide basic knowledge of the value of existing properly and role of computes in valuation;
5. Provide basic knowledge of specifications building and road works and
6. Prepare estimate of road and restoration works.

**Course Contents:**

**Theory**

**Unit 1: Introduction: [5 Hrs.]**
1.1. Terms used in Earthwork in road construction- Banking, Cutting, Side slope, Longitudinal section, Cross section, Mean Height
1.2. Terms used in Sanitary and Water supply works- Septic Tank, Soak Pit, Manhole
1.3. Distribution of water supply system (gravity and non-gravity system)

**Unit 2: Estimate of Road construction: [10 Hrs.]**
2.1 Various methods of earthwork calculation in road work- Mid Sectional Area method, Mean Sectional Area method, Prismoidal Formula method
2.2 Earthwork calculation of road work in plain area
2.3 Earthwork calculation of road work having vertical drop
2.4 Earthwork calculation of road work in hilly area
2.5 Estimate of different items of Flexible pavement works

**Unit 3: Analysis of Rates of Road, Sanitary and Water supply Works [8 Hrs.]**
3.1. Task or outturn work
3.2. Factor's affecting the cost of Road, Sanitary and Water supply works
3.3. Govt. procedure of preparing rate analysis of Road, Sanitary and Water supply works

**Unit 4: Property Valuation: [10 Hrs.]**
4.1. Definition
4.2. Purpose of valuation
4.3. Principle of valuation

4.4. Factors affecting the valuation of property
4.5. Definition of terms used in valuation- Value and Cost, Book value, Asset value, Distress value or Forced sale value, Replacement value, Annuity, Perpetual annuity, Differed annuity, Scrap value, Salvage value, Gross income, Outgoings, Net income, Capitalized value, Year's purchase, Sinking fund, Depreciation and its types
4.6. Method of Depreciation in property valuation- Straight line method with solved example, Constant percentage method with solved examples, Declining balance method with solved examples
4.7. Preparation of sample valuation report

**Unit 5: Specifications [12 Hrs.]**

5.1. Definition
5.2. Purpose of specification
5.3. Types of specification
5.4. Necessity of specification
5.5. Technique of specification
5.6. Paragraph of specification
5.7. General specification for Building work - Earthwork in excavation, Plain Cement Concrete work, Steel reinforcement, formwork, brick masonry work, stone masonry work, wood work for doors and windows frame and shutters, cement sand plaster work, CGI sheet roofing
5.8. General Specifications Road works: Embankment construction, Sub-grade, Base course, WBM road, Surface dressing using hot bitumen, Premix carpet

**Tutorial: [45 Hrs.]**

**Taking out detailed quantities and preparing estimate for the following:**

1 Calculate earthwork in road construction by three methods
2 Calculate earthwork of road in plain area
3 Calculate earthwork of road having vertical drop
4 Calculate earthwork of road in hilly area
5 Estimate metaled road of one Km
6 Evaluate report of properly valuation
7 Estimate restoration work of road

**References:**


1 Amarjit Agrawal "civil estimating quantity surveying and valuation, " Katson publishing house, Ludhiana, 1985.
2 M. Charkraborti' estimating, costing, specifications and valuation in civil engineering"
3 G.S. Berdie "text book of estimating and costing".


**Evaluation Scheme**

| Unit | Title | Hrs. | Mark Distribution |
|---|---|---|---|
| 1 | Introduction | 5 | 8 |
| 2 | Earthwork in road construction | 10 | 20 |
| 3 | Analysis of Rates (for road, sanitary and water supply works) | 8 | 20 |
| 4 | Valuation | 10 | 16 |
| 5 | Specifications | 12 | 16 |
| | | **45 Hrs.** | **80** |

**Design of Reinforced Concrete (RC) Structures**
**EG 3103 CE**

Year: III
Semester: I

Total: 8 Hrs. /week
Lecture: 4 Hrs./week
Tutorial: 2 Hrs./week
Practical: 2 Hrs./week
Lab: Hrs./week

**Course Description:**
This course provides the general ideas and design of RC members using relevant codes of practice. After completion of this course, students must be able to supervise RC constructions and he should be able to design simple RC members and prepare detail drawings of reinforcements in foundation, columns, beams, slabs, sills, lintels and also able to prepare ductile detailing of beam-column joints, column bases and bar bending schedule. Hence, it mainly focuses on the design of RC members and check as per code for strength and serviceability requirements.

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

1. Identify and select proper materials, calculate the design values for the materials.
2. Able to design structural elements of steel beams and columns- compression and tension members, timber beams, steel and timber joints.
3. Able to design structural elements of RCC: Slabs, beams, columns, stairs by LSM.
4. Understand concept of design and codal provisions
5. Able to prepare the proper detailing of structural members (steel, timber and reinforcement) and their connections using NBC: 101, 102, 103, 104, 105, 110; IS: 875, IS: 456-2000 & 2016, SP-34 & IS: 13920 and related codes of practice.

**Course Contents:**

**Unit1: Design Concept of Reinforced Concrete by Working Stress Method (WSM) [10 Hrs.]**

1.1 Concept of reinforced cement concrete (RCC) as composite material, role of reinforcement, requirements of materials, loads on structure as per NBC: 102, 103, 104, 106 & IS: 875.
1.2 Different grades of cement and steel. Properties of concrete and steel reinforcement (mild &HYSD bars), concept of characteristics strength, grades of concrete reinforcing bars.
1.3 Working Stress Method (WSM) of Design: Assumptions, merits and demerits/limitations.
1.4 Modular ratio, permissible-, ultimate stresses and factor of safety.
1.5 Stress strain diagram, actual and critical neutral axis (NA), position of NA, Lever Arm, Moment of Resistance (MR).
1.6 Under reinforced, over reinforced and balanced sections.
1.7 Behavior of RCC sections in bending
1.8 Analysis and design of singly reinforced rectangular sections.
1.9 Analysis and design of doubly reinforced rectangular sections.
1.10 Concept of shear reinforcement.

**Unit 2: Design Concept of Reinforced Concrete by Limit State Method (LSM) [4 Hrs.]**

2.1 Concept of different limit states and assumptions made in limit state of collapse.

2.2 Limit state of strength and serviceability. Safety and serviceability requirements/deflection control of structures as per codes.
2.3 Partial safety factor for loads, partial safety factor for materials, design strength of materials and design loads.
2.4 Stress-strain curves for concrete and steel, stress block, maximum strain in concrete, idealized stress-strain diagrams for steel and concrete.

**Unit 3: Design of Reinforced Concrete beams by Limit State Method (LSM) [14 Hrs.]**

3.1 Limiting values of NA for different grades of steel. Design bending moments and shear force. MR for singly and doubly reinforced rectangular sections.
3.2 Effective span for cantilever, simply supported and continuous beams, limits on area and spacing of reinforcement, side-face reinforcement as per NBC: 110 and IS 456:2000 & 2016.
3.3 Design of singly reinforced cantilever and simply supported rectangular beams. Numerical problems to evaluate moment of resistance and design related problems.
3.4 Design of doubly reinforced rectangular sections.
3.5 Behavior of T- and L-beams. Design of T- and L-beams.
3.6 Concept of continuous beams and knowledge on reinforcement placement.
3.7 Design of doglegged and open-well staircase.

**Unit 4: Design Concept of Reinforced Concrete Beams on Shear by LSM [8 Hrs.]**

4.1 Shear behavior and failure in shear with examples. Critical section for shear. Forms of shear reinforcement.
4.2 Design shear strength of concrete, maximum shear stress, design shear strengths of vertical/inclined stirrups/bent-up bars. Nominal shear stress.
4.3 Design of shear reinforcement in the form of vertical stirrups, inclined stirrups and bent-up bars. Minimum shear reinforcement. Simple design examples.
4.4 Bond between concrete and steel reinforcement, types of bond, bond stress, and check for bond stress.
4.5 Development length in tension and compression anchorage value of hooks, 90° bend and 45° bend, standard lapping of bars, check for development length.
4.6 Need for bar curtailment and detailing.

**Unit 5: Design Concept on one-way and two-way slabs by LSM [8 Hrs.]**

5.1 Introduction and classification of slabs. One-way and two-way slabs. Effective span of slab, live (imposed) loads on slabs (NBC: 103, IS: 875).
5.2 One-way slab design: Determination of slab thickness for simply supported slab to satisfy strength and stiffness requirements. Code requirement on the minimum/maximum area of reinforcement (main & secondary) and spacing of bars. Check for deflection and shear.
5.3 Introduction of cantilever and continuous slabs, design and reinforcement detailing.
5.4 Design of two-way slab: Effective span, classification of slabs as per code, bending moments (BM) coefficients for different edge conditions, design bending moments. Determine slab thickness and reinforcement bars for simply supported, restrained and continuous support condition to satisfy strength and stiffness requirements.
5.5 Edge and middle strips for different support conditions. Code requirements on the minimum/maximum area of reinforcement (main & secondary) and spacing

of bars, torsion reinforcement and curtailment of reinforcement. Check for deflection and shear.

**Unit 6: Design of Columns by LSM [10 Hrs.]**

6.1 Limit state of collapse in compression- assumptions.
6.2 Slenderness ratios, classification of columns, effective lengths. Minimum eccentricity for column loads.
6.3 Minimum/maximum reinforcement, number of bars in rectangular, square and circular sections, diameter and spacing of lateral ties as per NBC and IS codes.
6.4 Design of axially loaded short columns with lateral ties/helical reinforcement.
6.5 Reinforcement detailing and code requirements.
6.6 Introduction to long columns.
6.7 Column footing: Code requirements for square and rectangular footings as thickness, critical sections, minimum and maximum requirement on main and distribution reinforcement, minimum edge thickness, cover, anchorage and development lengths.
6.8 Design of isolated square and rectangular footings.

**Unit 7: Introduction to Pre-Stressed Concrete: [6 Hrs.]**

7.1 Concept of pre-stressing
7.2 Materials used in pre-stressed concrete and their requirements.
7.3 Methods of pre-stressing: pre-tensioning and post-tensioning
7.4 Systems of pre-stressing and post-tensioning.
7.5 Losses in pre-stress.
7.6 Merits and demerits of pre-stressing and post-tensioning.
7.7 Sagging profile of cable for post-tensioning.

**Tutorial: [30 Hrs.]**

1. Problems related to under reinforced, over reinforced and balanced sections in WSM.
2. Numerical problems on determining design constants, moment of resistance and area of steel for singly and doubly reinforced beams by WSM.
3. Moment of resistance and design of singly reinforced cantilever and simply supported rectangular beams by LSM.
4. Evaluation of moment of resistance and design of doubly reinforced rectangular sections by LSM.
5. Problems on design of shear reinforcement in the form of vertical stirrups, inclined stirrups and bent-up bars. Check for minimum shear reinforcement.
6. Determination of development length and check.
7. Design of one-way slabs. Check for deflection and reinforcement requirement.
8. Design of two-way slabs for different edge conditions.
9. Problems related to design of doglegged staircase.
10. Design of axially loaded short columns with lateral ties/helical reinforcement.
11. Design of square and rectangular footings.

**Practical:** **[30 Hrs.]**

**Design and draw followings:**

1. Singly reinforced rectangular beams with reinforcements detailing
2. Doubly reinforced rectangular beams
3. Singly reinforced T– beams and L-beams
4. One-way slabs (simply supported, cantilever and overhang)
5. Two-way slab with different edge conditions
6. Doglegged and open-well staircases
7. Short and long columns (axially loaded)
8. Simple pad footings for columns
9. Prepare a column-beam joint showing bars as per ductile detailing code requirement.
10. Preparation of bar bending schedule for all RC drawings
11. Introduction to structural analysis software (SAP, ETABS, STAAD Pro. etc.)

**** Note: IS: 456 is allowed in the examination***.

**Text Books:**

1. A. k. Jain, "Design of RC Structures",……(LSM)
2. C. M. Kale, "RCC Structures",…….. (WSM)

**References:**


1. S Pillai and D Menon, “Reinforced Concrete Design”, Tata McGraw Hill Publishing Co., New Delhi.
2. P. Dayaratnam, “Design of Reinforced Concrete Structures”, Oxford & IBH Publishing Company.
3. R Suwal, “Design of Reinforced Concrete Structures”, A.K. Book Publication, Kathmandu
4. NBC 101, 102, 103, 104, 105, 110, Nepal standards and related codes of practice.
5. IS: 456-2000 & 2016, SP-34 & IS 13920 and related codes of practice.
6. BS, EURO codes, FEMA and relevant codes.


**Evaluation System**

| Unit | Title | Hrs. | Marks |
|---|---|---|---|
| 1 | Design Concept of Reinforced Concrete by Working Stress Method (WSM) | 10 | 12 |
| 2 | Design Concept of Reinforced Concrete by Limit State Method (LSM) | 4 | 4 |
| 3 | Design of Reinforced Concrete beams by Limit State Method (LSM) | 14 | 24 |
| 4 | Design Concept of Reinforced Concrete Beams on Shear by LSM | 8 | 12 |
| 5 | Design Concept on one-way and two-way slabs by LSM | 8 | 12 |
| 6 | Design of Columns by LSM | 10 | 12 |
| 7 | Introduction to Pre-Stressed Concrete: | 6 | 4 |
| **Total** | | **60** | **80** |

**Transportation Engineering I**
**EG 3104 CE**

**Year: III** **Total: 5 Hrs. /week**
**Semester: I** **Lecture: 3 Hrs./week**
**Tutorial: 1 Hr./week**
**Practical: Hrs./week**
**Lab: 2/2 Hrs./week**

**Course Description:**
This course is aimed to provide general background knowledge of highway engineering putting emphasis on alignment survey, geometric design, drainage, highway materials.

**Course Objectives:**
After the completion of this course, students will be able to:
1. Describe highway alignments and conduct its engineering survey;
2. Understand the principles of geometric design, both vertical and horizontal together with drainage components of highway;
3. Differentiate between the various types of materials used in road construction and
4. Perform different test of road construction materials.

**Course Contents:**

**Unit 1: Introduction to Transportation System: [6 Hrs.]**
- 1.1. Introduction
- 1.2. Comparison of different modes of transportation system, suitability in Nepal
- 1.3. Road transport and its advantages/disadvantages
- 1.4. History of road development
  - 1.4.1 Roman roads construction technique
  - 1.4.2 Tresaguet road construction technique
  - 1.4.3 Telford road construction technique
  - 1.4.4 Macadam road construction technique
  - 1.4.5 Comparison between Telford and Macadam
  - 1.4.6 Modern road construction
- 1.5. Road construction in Nepal
- 1.6. Road classification as per Nepal Road Standard (functional classification only), National, Feeder, District, Urban and Village road.
- 1.7. Urban road patterns
  - 1.7.1 Grid iron pattern
  - 1.7.2 Radial pattern

**Unit 2: Highway Alignment and Engineering Survey: [4 Hrs.]**
- 2.1. Introduction
- 2.2. Requirements of ideal highway alignment
- 2.3. Factors controlling highway alignment
- 2.4. Engineering survey for highway alignment
  - 2.4.1. Map study
  - 2.4.2. Reconnaissance,
  - 2.4.3. Preliminary survey
  - 2.4.4. Final location and detailed survey

**Unit 3: Geometric Design of Highways:** **[20 Hrs.]**

- 3.1. Introduction
- 3.2. Basic road terms
  - 3.2.1. Traffic volume (introduction only)
  - 3.2.2. Traffic capacity (introduction only)
  - 3.2.3. Skid/slip (introduction only)
- 3.3. Cross sectional elements
  - 3.3.1. Typical drawings of highway cross sections, rural roads/ urban roads
- 3.4. Camber
  - 3.4.1. Definition
  - 3.4.2. Objectives
  - 3.4.3. Types
  - 3.4.4. camber board preparation with numerical example
- 3.5. Highway curves
  - 3.5.1. Introduction, Types (Horizontal & Vertical)
  - 3.5.2. Necessity
  - 3.5.3. Design of horizontal curves (Effect of centrifugal force, transition curve with numerical examples)
- 3.6. Superelevation
  - 3.6.1. Definition
  - 3.6.2. Objectives
  - 3.6.3. Analysis of superelevation with numerical example of superelevation design in mixed traffic condition
  - 3.6.4. Methods of providing superelevation
- 3.7. Extrawidening
  - 3.7.1. Definition
  - 3.7.2. Objectives
  - 3.7.3. Analysis of mechanical widening with numerical example for calculating total widening
  - 3.7.4. Methods of providing extrawidening
- 3.8. Sight distance
  - 3.8.1. Definition
  - 3.8.2. Types
  - 3.8.3. Objectives
  - 3.8.4. Examples of situations restricting sight distance
  - 3.8.5. Numerical example of SSD & OSD
- 3.9. Gradient
  - 3.9.1. Definition
  - 3.9.2. Types (Rolling, Limiting, Exceptional, Minimum gradient)
  - 3.9.3. Factors governing the selection of grades, effect of high grades
  - 3.9.4. Grade compensation in horizontal curves (introduction only)
- 3.10. Vertical curves
  - 3.10.1. Definition
  - 3.10.2. Types (Summit & Valley)
  - 3.10.3. Design of summit curves (minimum length requirement based on stopping sight distance with numerical example)
  - 3.10.4. Design of valley curves (minimum length requirement based on both comfort and head light sight distance with numerical example)

**Unit 4: Highway Drainage:** **[5 Hrs.]**

4.1. Introduction and important of highway drainage
4.2. Causes of moisture variation in subgrade soil (By ground water & By free water concept only)
4.3. Requirements of good drainage system
4.4. Classification of highway drainage system
    4.4.1. Surface drainage (Types, longitudinal: lined and unlined, transverse, energy dissipating definitions), Drainage in rural highway, urban street, hill road concept, Design of surface drainage system (Numerical trapezoidal section)
    4.4.2. Subsurface drainage (Control of seepage flow, capillary rise, lowering of water table)
    4.4.3. Cross drainage (General, concept of causeways, inverted syphon, aqueduct, culverts: slab, box, arch & pipe)
    4.4.4. Energy dissipating structures: concept only.

**Unit 5: Highway Materials:** **[10 Hrs.]**

5.1. Classification of highway materials: Introduction, Classification based on purpose binding, mineral, other minerals.
5.2. Subgrade soil
    5.2.1. Uses
    5.2.2. Requirements of soil as a highway material
    5.2.3. California Bearing Ratio (CBR) test of soil (Test procedure)
5.3. Stone aggregates
    5.3.1. Definition
    5.3.2. Types: based on strength, grain size, shape, gradation basic concept only.
    5.3.3. Desirable properties of road aggregates
    5.3.4. Tests on road aggregates (Los Angeles Abrasion test, Aggregate Impact test, Water absorption test, Specific Gravity test, Shape test)
5.4. Binding materials (bituminous material):
    5.4.1. Introduction
    5.4.2. Types of binding materials (bitumen, tar), natural bitumen, petroleum bitumen, cutback bitumen, bituminous emulsion
5.5. Tests on bitumen: penetration test, ductility test, viscosity test, softening point test

**Tutorials** **[15 Hrs.]**

Unit 3 Geometric Design of Highways [12 H]
Unit 4 Highway Drainage: [3H]

**Practical (laboratory)** **[15 Hrs.]**

1. Perform California bearing test of soil
2. Perform Los Angeles Abrasion test of aggregate
3. Perform penetration test of bitumen
4. Perform softening point test of bitumen
5. Perform ductility test of bitumen

**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. Ajay K Duggal, Vijaya P. Puri, Laboratory manual on Highway Engineering, New Age International (P) Limited, New Delhi, India.
5. S. K. Sharma, Principles, Practice and Design of Highway Engineering, S Chand and Company Ltd. New Delhi.

**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+T) | Marks distribution |
|---|---|---|---|
| 1 | Introduction to Transportation System | 6 | 12 |
| 2 | Highway Alignment and Engineering Survey | 4 | 16 |
| 3 | Geometric Design of Highways | 20+12 | 36 |
| 4 | Highway Drainage | 5+3 | 16 |
| 5 | Highway Materials | 10 | 16 |
| | **Total** | **60** | **96** |

**Note:**

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

**Sanitary Engineering**
**EG 3105 CE**

**Year: III** **Total: 4 Hrs. /week**
**Semester: I** **Lecture: 3 Hrs./week**
**Tutorial: 1 Hr./week**
**Practical: Hrs./week**
**Lab: Hrs./week**

**Course Description:**
The course aims at developing fundamental knowledge of sanitary engineering such as sewerage system, preliminary sewage treatment system, on site sanitation systems and solid waste management.

**Course Objectives:**
After completion of the course, the students will be able to:

1. Introduce sanitation and health, main diseases transmitted due to unsanitary excreta disposal;
2. Explain the process of wastewater collection, conveyance, treatment and disposal methods and design of sewers;
3. Be familiar/Familiarize with the fundamental problems, issues related to wastewater and its management;
4. Describe the onsite sanitation systems and
5. Explain the importance and methods of solid waste disposal.

**Course Contents:**

**Unit 1: Sanitation and health** **[6 Hrs.]**

- 1.1. Introduction
- 1.2. Main diseases transmitted by unsanitary excreta disposal
- 1.3. Transmission routes
- 1.4. Preventive measures
- 1.5. Importance of sanitation, awareness of public health engineering
- 1.6. Definitions of common terms used in sanitary engineering
  - 1.6.1. Sewage/wastewater, domestic sewage, industrial sewage, sanitary sewage, storm water
  - 1.6.2. Sullage, sewer, sewerage, rubbish, garbage, refuse and solid waste
- 1.7. System of sanitation
  - 1.7.1. Conservancy system with merits and demerits
  - 1.7.2. Water carriage system with merits and demerits
- 1.8. Sewerage systems and types
  - 1.8.1. Separate system
  - 1.8.2. Combined system
  - 1.8.3. Partially separate system
  - 1.8.4. Comparison in tabular form between separate and combined systems

**Unit 2: Quantity of Sewage:** **[4 Hrs.]**

- 2.1. Sources of sanitary sewage
- 2.2. Dry Weather Flow (DWF) and Wet Weather Flow (WWF)
- 2.3. Factors affecting quantity of sanitary sewage
  - 2.3.1 Population
  - 2.3.2 Rate of water supply

2.3.3 Groundwater infiltration
2.3.4 Unauthorized connections

2.4. Determination of quantity of sanitary sewage -, peak factor, peak flow, minimum and maximum flows
2.5. Determination of quantity of storm water- Rational method and its limitation, Overall runoff coefficient, intensity of rainfall, Time of concentration
2.6. Numerical on determination of quantity of wastewater for separate, combined and partially separate systems

**Unit 3: Design and Construction of Sewers: [4 Hrs.]**

3.1. Shapes of sewer-Circular and non-circular sections with merits and merits
3.2. Sewer Materials
3.2.1. Requirement of sewer materials
3.2.2 Types of sewer materials - salt glazed stoneware, cement concrete, cast iron
3.3. Design criteria of sewers - design period, minimum and maximum velocities, self-cleansing velocity, sewer size range, sewer gradient
3.4. Hydraulic formulae for design Manning's, Chezy's and Hazen Williams formulae, hydraulic elements of circular sewers for partial flow condition, partial flow diagrams
3.5. Numerical on design of circular and rectangular sewers

**Unit 4: Sewer Appurtenances (only introduction): [4 Hrs.]**

4.1. Necessity of sewer appurtenances
4.2. Construction of sewer appurtenances- (location, function and construction)
4.2.1. Manhole
4.2.2. Drop manhole
4.2.3. Street inlets
4.2.4. Catch basin
4.2.5. Flushing device
4.2.6. Inverted siphon
4.2.7. Ventilating shaft
4.2.8. Water closet
4.2.9. Trap
4.2.10. Sand, grease and oil traps

**Unit 5:Sampling and Characteristics of Wastewater (introduction only): [3 Hrs.]**

5.1. Sampling of wastewater - grab and composite samples
5.2. Biochemical Oxygen Demand (BOD)
5.3. Chemical Oxygen Demand (COD
5.4. Decomposition of wastewater-process, aerobic and anaerobic decomposition, reactions
5.5. Wastewater disposal Standards

**Unit 6: Wastewater Disposal: [5 Hrs.]**

6.1. Necessity and objectives of wastewater disposal
6.2. Wastewater disposal by Dilution process and essential conditions for dilution
6.3. Self-purification of rivers/streams and sag curve
6.4. Factors affecting self-purification - Dilution, Current, Sunlight, Sedimentation, Temperature, Oxidation, Reduction

6.5. Wastewater disposal by land treatment and Suitability of land treatment
6.6. Methods of land treatment - irrigation, overland flow and rapid infiltration, Broad irrigation and sewage farming, Methods of application of sewage on land - flooding, surface irrigation, ridge and furrow method, subsurface irrigation and spray irrigation
6.7. Sewage sickness and its prevention

**Unit 7: Wastewater Treatments: [9 Hrs.]**

7.1. Objectives
7.2. Treatment process types and impurity removal
7.3. Primary treatment process
  7.3.1. Racks and Screens - purpose and types, design criteria, construction, working and maintenances
  7.3.2. Skimming tank – purpose and types, design criteria, construction, working and maintenances
  7.3.3. Grit chamber - purpose and types, design criteria, construction, working and maintenances
7.4. Waste stabilization pond - purpose and types, design criteria, construction, working and maintenances
7.5. Constructed wetland - purpose and types, design criteria, construction, working and maintenances
7.6. Numerical on design of Racks and Screens, Skimming tank, Grit chamber, Waste stabilization pond and Constructed wetland

**Unit 8: On site Sanitations for Isolated / Unsewered Area: [8 Hrs.]**

8.1. Necessity
8.2. On site sanitation - Definition and types
8.3. Pit privy - purpose and construction
8.4. Ventilated Improved Pit (VIP) latrine - purpose, construction, design criteria (single pit only)
8.5. Compost latrine- purpose and types, design criteria, construction, working and maintenances
8.6. Septic tank - purpose, construction, design criteria, working and maintenance
8.7. Disposal of septic tank effluent methods
8.8. Drain field - purpose, construction and design criteria
8.9. Soak pit - purpose, construction and design criteria
8.10. Leaching cesspool - purpose
8.11. Numerical on design of VIP latrine, Septic tank and Soak pit

**Unit 9: Solid Waste Disposal: [2 Hrs.]**

9.1. Characteristics of solid waste
9.2. Quantity of solid waste
9.3. Collection and transportation of solid waste
9.4. Methods of solid waste disposal
  9.3.1. Dumping
  9.3.2. Sanitary landfill
  9.3.3. Incineration
  9.3.4. Composting

**Tutorials:**

1. **Introduction** **[1 Hr.]**
   Definitions
2. **Quantity of Wastewater** **[2 Hrs.]**
   Definitions, Numerical on determination of sanitary sewage and storm water, determination on quantity of wastewater for separate, combined and partially separate systems
3. **Design and Construction of Sewers** **[2 Hrs.]**
   Design criteria of sewers, partial flow conditions in sewers, Numerical on design of circular and rectangular sewers for separate and combined systems
4. **Sewer Appurtenances** **[2 Hrs.]**
   Definitions and sketches
5. **Sampling and Characteristics of Wastewater** **[1 Hr.]**
   Definitions, standards
6. **Wastewater Disposal** **[1 Hr.]**
   Definitions, drawing sag curve
7. **Wastewater Treatment** **[2 Hrs.]**
   Numerical on design of Racks and Screens, Skimming tank, Grit chamber, Waste stabilization pond and Constructed wetland
8. **Disposal of Sewage from Isolated Buildings** **[3 Hrs.]**
   Definitions, Numerical on design of VIP latrine, Pour flush latrine, Septic tank and Soak pit
9. **Solid Waste Disposal** **[1 Hr.]**
   Definitions, purpose, classification

**References:**


1. B. C. Punmia and Ashok Jain, "Wastewater Engineering", Laxmi Publications (P) Ltd., New Delhi
2. P.N. Modi, "Sewage Treatment & Disposal and Wastewater Engineering", Standard Book House, Delhi.
3. G.S. Birdie and J, S, Birdie, "Water Supply and Sanitary Engineering", Dhanpat Rai Publishing Company (P) Ltd., New Delhi
4. K.N. Duggal, "Elements of Environmental Engineering", S. Chand and Company Ltd., New Delhi.


**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+T) | Marks distribution |
|---|---|---|---|
| 1 | Introduction | 6+1=7 | 8 |
| 2 | Quantity of Wastewater | 4+2=6 | 8 |
| 3 | Design and Construction of Sewers | 4+2=6 | 8 |
| 4 | Sewer Appurtenances | 4+2=6 | 8 |
| 5 | Sampling and Characteristics of Wastewater | 3+1=4 | 4 |
| 6 | Wastewater Disposal | 5+1=6 | 8 |
| 7 | Wastewater Treatment | 9+2=11 | 16 |
| 8 | Disposal of Sewage from Isolated Buildings | 8+3=11 | 16 |
| 9 | Solid Waste Disposal | 2+1=3 | 4 |
| | **Total** | **60** | **80** |

*There may be minor variation in marks distribution.

The questions setting should be in the multiplication of 4

**Construction Management**
**EG 3106 CE**

**Year: III**
**Semester: I**

Total: 6 Hrs./week
Lecture: 5 Hrs./week
Tutorial: 1 Hr./week
Practical: Hrs./week
Lab: Hrs./week

**Course Description**

This course focuses on management of construction works. This course imparts knowledge on organization, Management, labor relations, safety, accounts, procurement of works, contract management, planning, scheduling, monitoring and control, and managing construction works.

**Course Objectives**

After completion of this course, students will be able to:

1. Familiarize the need of organization, and account;
2. Describe construction management;
3. Plan and schedule different activities of construction project;
4. Familiarize with monitoring and control, labor relations, and safety in construction works;
5. Familiarize with the procurement of works and contract administration; and
6. Plan and schedule resources required in construction project.

**Course Content**

**Unit 1: Organization and Management [8 Hrs.]**

1.1 Definition and need of organization
1.2 Types of organization - Line organization, Line and staff organization, and Matrix organization.
1.3 Definition and importance of Management
1.4 Principles of Management
1.5 Human Resource Management
1.6 Motivation
1.7 Definition and Need of Construction Management

**Unit 2: Bookkeeping and Account [6 Hrs.]**

2.1 Definition of Bookkeeping
2.2 Need and Importance of Accounting
2.3 Principle of Double Entry - Personnel account, Property or Real account, and Nominal account
2.4 Introduction to Journal, Ledger and Final account

**Unit 3: Project Planning and Scheduling [12 Hrs.]**

3.1 Definition and Characteristics of Project
3.2 Definition and Steps of Planning
3.3 Importance of Planning
3.4 Construction Site Planning
3.5 Work Breakdown Structure

3.6 Bar Chart with advantages and disadvantages, Linked Bar Chart, and Milestone Bar Chart
3.7 Definition of Scheduling, Preparation of Construction Schedule and its advantages
3.8 Preparation of Schedule of Resources (Material/Labor/Equipment and Finance)

**Unit 4: CPM and PERT [14 Hrs.]**

4.1. Introduction to CPM
4.2. Elements of Network
4.3. Network Rules
4.4. Definition of the Terms: Network Diagram, Activity, Event, Forward Pass, Backward Pass, and Critical Path.
4.5. Introduction to activity on arrow (A-O-A) method with one example.
4.6. Computation of four schedule dates, four floats, critical path, and determination of project duration using (A-O-N) method.
4.7. Introduction to PERT with one example.

**Unit 5: Contract Administration [14 Hrs.]**

5.1 Definition of Contract, and Definition of Contract Administration
5.2 Essentials elements of a Valid Contract
5.3 Types of Contract: Unit Price Contract/Lump Sum Contract/Cost Plus Contract
5.4 Definition of Tender Notice, and Information to be given in Tender Notice
5.5 Difference between Tender Document and Contract Document
5.6 Bid Bond and Performance Bond
5.7 Conditions of Contract
5.8 Supervision of work undertaken by a Contractor
5.9 Duties and Responsibilities of a Site Supervisor
5.10 Site Order Book
5.11 Materials at Site Account
5.12 Muster Roll
5.13 Measurement Book
5.14 Running Bill and Final Bill
5.15 Completion Report
5.16 Relation between Owner, Consultant, and Contractor

**Unit 6: Monitoring and Quality Control [7 Hrs.]**

6.1 Introduction to Monitoring
6.2 Purpose of Monitoring
6.3 Definition of Quality
6.4 Characteristics of Quality
6.5 Elements of Control: Quality control/Cost control/Schedule control
6.6 Stages of Quality Control

**Unit 7: Construction Equipment [8 Hrs.]**

7.1. Advantages of using Construction Equipment
7.2. Equipment for Excavation
7.3. Equipment for Concrete Mixing
7.4. Equipment for Transportation and Compaction
7.5. Equipment for Lifting of Materials and Parts

**Unit 8: Safety and Labor Relation [6 Hrs.]**

8.1 Introduction to Accidents

8.2 Causes of Accidents
8.3 Importance of Safety
8.4 Safety Measures
8.5 Meaning and Purpose of Labor Union
8.6 Labor Act 2074

**Tutorial Works**

Bookkeeping and Account [05 Hrs.]
CPM and PERT [10 Hrs.]

**References:**


1. Adhikari, R. P., Construction Management.
2. Shrestha, S.K. and Adhikari, I. A text book of Project Engineering, Chandeswori Publication.
3. Shrestha, S.M. and Shrestha, S. Management-I, Akshalok Prakashan, Kathmandu, Nepal.
4. Bhattarai D. Construction Plant Management. P.U. Printers Battisputali, Kathmandu, Nepal.
5. Chitkara K, Construction Project Management. Tata McGraw-Hill Education Private Limited, New Delhi, India
6. Dutta, B. N., Estimating and Costing.
7. DeCenzo, D.A. and Robbins, S.P. Personnel/Human Resource Management, Third Edition. Prentice-Hall of India, New Delhi.


**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 | Organization and Management | 08 | 08 |
| 2 | Bookkeeping and Account | 06 | 08 |
| 3 | Project Planning and Scheduling | 12 | 12 |
| 4 | CPM and PERT | 14 | 16 |
| 5 | Contract Administration | 14 | 12 |
| 6 | Monitoring and Quality Control | 07 | 08 |
| 7 | Construction Equipment | 08 | 08 |
| 8 | Safety and Labor Relation | 06 | 08 |
| | **Total** | **75** | **80** |

* There may be minor deviation in marks distribution.

**Design of Steel and Timber Structures**
**EG 3107 CE**

Year: III
Semester: I

Total: 4 Hrs. /week
Lecture: 2 Hrs./week
Tutorial: 1 Hrs./week
Practical: 1 Hrs./week
Lab: Hrs./week

**Course Description:**
This course provides the general ideas and design of steel and timber structural members using relevant codes of practice. After completion of this course, students must be able to supervise steel fabrication and construction and he should be able to design simple steel and timber members and joints. Hence, it mainly focuses on the design of tension, compression, flexural members for axial, bending moment, shear and check as per code for strength and serviceability requirements.

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

6. Identify and select proper materials, calculate the design values for materials.
7. Able to design structural elements of steel beams and columns- compression and tension members, timber beams, steel and timber joints.
8. Understand concept of design and code provisions
9. Able to prepare the proper detailing of structural members (steel & timber) and their connections using NBC 101, 102 103, 104, 105, 111, 112; IS: 800 and related codes of practice.

**Course Contents:**

**Theory**

**Unit 1: Introduction** **[2 Hrs.]**

1.1 Types of rolled steel sections used in steel structures.
1.2 Grades of steel and characteristics strength; advantages and disadvantages of steel structures; use of steel table and relevant NBC: & IS: 800 codes
1.3 Types of loads on steel structure and its code specification. Codes of practice for design of steel structures
1.4 Methods of analysis and design

**Unit 2: Working Stress Design Method (WSM)** **[3 Hrs.]**

2.1 Basic assumptions in working stress design
2.2 Service load and permissible stresses
2.3 Design for tension, compression and bending

**Unit 3:Limit State Design Method (LSM)** **[1 Hrs.]**

3.1 Different limit states for steel design
3.2 Design strength of materials and design loads
3.3 Limit state of strength and serviceability

**Unit 4: Joints in the Steel Structures:** **[4 Hrs.]**

4.1 Types of joints: Rived, bolted and welded joints
4.2 Limit state of failure of failure of riveted and bolted joints
4.3 Rivets value and efficiency of joints

4.4 Design of simple riveted bolted joints under axial loads
4.5 Design of simple welded connections under axial loads

**Unit 5: Design of Tension Members: [4 Hrs.]**

5.1 Introduction
5.2 Types of tension members
5.3 Net sectional area of tension members
5.4 Design of members subjected to axial load: Simple and built-up beams
5.5 Introduction to tension splices and lug angles

**Unit 6: Axially loaded Compression Members-Tubular and angle section: [4 Hrs.]**

6.1 Introduction and Types of compression members
6.2 End condition, Effective lengths and their buckling behavior
6.3 Radius of gyration and slenderness ratio
6.4 Strength of compression members
6.5 Design of compressive members: Simple and built-up sections

**Unit 7: Design of Flexural Members: [2 Hrs.]**

7.1 Introduction and Types of flexural members
7.2 Design of simple I-beams

**Unit 8: Design of Roof Trusses: [2 Hrs.]**

8.1 Types of roof trusses and their components
8.2 Different types of loads on roof truss
8.3 Introduction to the design of roof trusses
8.4 Tubular sections

**Unit 9: Timber Structures: [2 Hrs.]**

9.1 Introduction of timber
9.2 Properties of timber
9.3 Use of timber as a structural member in construction, timber structures and factors affecting strength of timber
9.4 Code of practice (IS: 883) for design of timber structures; strength of timber
9.5 Advantage & disadvantage of timber structure

**Unit 10: Design of Timber Structure: [6 Hrs.]**

10.1 Design of compression members
10.2 Design of solid rectangular beam
10.3 Check for deflections
10.4 Types of joints and their connection

**** Note: IS: 800, IS: 883 and steel table are allowed in the examination***.

**Tutorials [15 Hrs.]**

1. Design of tension, compression, bending and shear members using WSM
2. Determination of rivets value and efficiency of joints.
3. Design of simple riveted bolted joints under axial loads with joint details
4. Design of simple welded connections under axial loads with joint details
5. Determination of net sectional area of tension members and their capacity.

6. Design of members subjected to axial load: Simple and built-up sections and lateral bracings.
7. Design of simple beams and simple built-up beams.
8. Introduction to different components of plate girders.
9. Design of simple steel roof trusses using rolled steel sections.
10. Design of simple compression timber members.
11. Design of simple flexural timber members.

**Practical** **[15 Hrs.]**

**Design and draw followings:**

1. Details bolted and riveted joints.
2. Details of welded joints.
3. Steel beam-column connection and column bases.
4. Steel roof truss joint details with riveted, bolted and welded connections.
5. Timber roof truss joint details using steel plates with bolted connections.
6. Common joints in different timber members of heritage structures.
7. Timber beam and column joint details.

**References:**


1. S Negi, "Design of Steel & Timber Structures", Tata McGraw Hill Publishing Co., New Delhi.
2. Dr. NR Chandak, "Design of Steel Structures", SK Kataria and Sons, New Delhi.
3. R Suwal, "Design of Steel and Timber Structures", R & R Group, Kathmandu
4. NBC 101, 102, 103, 104, 105, 111, 112, 113, other related codes and Nepal standards.
5. IS: 875 & 800 and related codes of practice.
6. BS, EURO codes, FEMA and relevant codes.


**Evaluation System**

| Unit | Title | Hrs. | Marks |
|---|---|---|---|
| 1 | Introduction | 2 | 6 |
| 2 | Working Stress Design Method (WSM) | 3 | |
| 3 | Limit State Design Method (LSM) | 1 | 6 |
| 4 | Joints in the Steel Structures: | 4 | |
| 5 | Design of Tension Members: | 4 | 8 |
| 6 | Axially loaded Compression Members-Tubular and angle section | 4 | |
| 7 | Design of Flexural Members | 2 | 8 |
| 8 | Design of Roof Trusses | 4 | |
| 9 | Timber Structures | 2 | 12 |
| 10 | Design of Timber Structure | 4 | |
| **Total** | | **30** | **40** |

**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)<br>A: Trail Bridge<br>B: Hill Road<br>C: Hill Irrigation Engineering<br>D: Gravity Flow Water Supply System<br>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 |
|---|---|
| • Understand reconnaissance survey, establishment of horizons control stations, pegging of major traverse and minor traverse stations.<br>• Able to draw reference sketch of survey stations and index sketch of the area to be surveyed.<br>• Understand the process of measurement of horizontal circle reading and vertical circle reading;<br>• Be able to compute horizontal angles and horizontal distances.<br>• Understand the computational procedures of X, Y and Z coordinates in the Gales Table. | **UNIT 1: Horizontal Control for Major Traverse**: (**2 Days)**<br><br>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.<br><br>**Norms:**<br>• One set of horizontal angles (o° set).<br>• Traverse leg ratio 2:1 (Max: Min)<br>• Linear measurement accuracy 1:5,000 for Total Station and 1:2,000 for Tape measurement.<br>• Difference between FL and FR reading =180°±30" for Total Station and 180°±01' for Theodolite.<br>• Angular Accuracy (LC√N) = (**45"** √**N**) for Total Station and (**1.5'**√**N**) for Theodolite.<br>• 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.<br>• Understand Fly Levelling to Transfer RL from the permanent BM (or given BM) to SBM/TBM;<br>• Know the process to be followed in Fly Levelling such as:<br>• 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);<br>• Turning Plate must be used in each Changing/Turning points;<br>• Staff readings should be observed above 0.6m and below 2m for fly levelling. | **Days)**<br>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.<br>**Time Allocation:**<br>• 1 Day for fly leveling and RL transfer from Bench Mark (BM) to Site Bench Mark (SBM)<br>• 1 Days for detailing in minor traverse<br>• 1 Day for computation and plotting of traverse etc.<br>**Norms of Horizontal Control:**<br>• One set of horizontal angles (o° set).<br>• Traverse leg ratio 3:1 (Max: Min)<br>• Linear measurement accuracy ≥ 1:5,000 for Total Station and ≥ 1:2,000 for direct Tape measurement.<br>• Difference between FL and FR reading =180°±30" for Total Station and 180°±01' for Theodolite.<br>• Angular Accuracy (LC√N) = (**1'0"**√**N**) for Total Station and (**2'0"**√**N**) for Theodolite.<br>**Norms of Vertical Control:**<br>• Collimation precision of Two Peg Test should be ≥1:10,000.<br>• Circuit must be closed while transferring RL in Major and Minor Traverse stations.<br>• 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).<br>• Perform Reciprocal Levelling to transfer RL from one bank of the river to another bank of the Bridge Axis point.<br>• Perform the detailed topographic survey of bridge site.<br>• Be able to plot the topographic map of Bridge Site Survey, L - Section | **UNIT 3: Bridge Site Survey (1.5 Days)**<br>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.<br>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.<br>**Norms:**<br>• While choosing control stations of triangulation, Triangles should be in well condition.<br>• One set of horizontal angles (0° set) in Base Triangles and in other Triangles.<br>• 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.<br>• 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.<br>• Angular Accuracy (LC√N) =(**1.5'√N**) for Base Triangles and for other Triangles.<br>• 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).<br>• Perform Fly Levelling and close the circuit to transfer RL in all control stations. |
| • Understand the techniques of selection of Intersection Points (IP).<br>• Measure clockwise angle horizontal circle reading (HCR) with respect to previous IP and forward IP to determine Deflection angle.<br>• Understand to compute chainage along the center line of road alignment.<br>• Be able to establish points in the simple circular curve like BC, MC, and EC.<br>• Understand to take L – Section by Level; and X– Section by both Level instrument and by stepping method (staff and Tape).<br>• 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)**<br>• Length of road alignment survey shall be at least 400m.<br>• Road corridor plan, L - section, X - section etc. shall be drawn at standard scale including selection of grades and formation levels etc.<br>**Norms**<br>• As far as possible, select IP in such a way that deflection angles should be < 90° (desirable).<br>• Gradient between adjacent Intersection Points (IP to IP) should be ≤ 12%.<br>• Minimum Radius of the curve should be > 12m; choose the Radius of the curve in the multiple of 10m or 5m.<br>• Successive curve must not be overlapped.<br>• Observe only face left horizontal circle reading by Theodolite and measure deflection angles at each Intersection Point.<br>• 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.<br>• In case of deflection angles being <3°, MC need not be established as External Distance become very small near to Vertex (IP points).<br>• 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 ।