

**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 Fourier's series in an interval of period  $2\pi$  (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
		<b>14 x 2 = 28</b>	<b>13 x 4 = 52</b>	<b>80</b>

#### 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. Krysizig E., Advanced Engineering Mathematics, wile-Easter Publication, New Delhi, 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 Distributors 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:

<b>Chapter</b>	<b>Title</b>	<b>Hrs.</b>	<b>Marks distribution*</b>
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
<b>Total</b>		<b>45</b>	<b>80</b>

\* 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, spirit 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

7.2 Prepare/handle/spread mortar with trowel

7.3 Build 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.]**

8.1 Build 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.]**

10.1 Build 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
	<b>Total</b>		<b>30</b>

## 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 loosening/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°
- 6.5. Clean, trim and weld the two halves of pipe to form 90° 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 90°
- 7.5 Clean, trim and join the two halves of pipe to form 90°elbow (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
	<b>Total</b>		<b>20</b>

### **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

<b>Practical</b>	<b>[45 Hrs.]</b>
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
	<b>Total</b>	<b>60 Hrs</b>	<b>80</b>

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

**Year: II**  
**Semester: I**

**Total: 7 Hrs. /week**  
**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, buttress
- 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 filling 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. Special 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, fascia 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:

<b>Chapter</b>	<b>Title</b>	<b>Hrs.</b>	<b>Mark distribution*</b>
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**  
**Semester: I**

**Total: 5 Hrs. /week**  
**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.]

3.1 Types of tiles: Roofing tiles, wall tiles, clay pipes and uses in construction

3.2 Manufacturing of tiles

3.3 Properties of tiles

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

4.1 Introduction

4.2 Classification of limes: Fat Lime (white lime), Lean lime, and Hydraulic lime.

4.3 Setting action of lime

4.4 Manufacturing of lime

4.5 Raw materials, burning, slaking

4.6 Intermittent and continuous methods of manufacture

4.7 Testing 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