CURRICULUM

DIPLOMA
Agricultural Engineering
[Three-year program-semester system]

Council for Technical Education and Vocational Training
Curriculum Development and Equivalence Division
Sanothimi, Bhaktapur
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Introduction

This curriculum is designed with the purpose of producing middle level technical workforce equipped with knowledge and skills related to the field of Agricultural Engineering so as 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 Agricultural Engineering.

This curriculum is designed to foster knowledge and skills based on the job required to perform by the Agricultural Engineering Technicians [Agricultural Overseer] at different levels of public and private sectors for physical infrastructures development related works in Nepal. The Diploma in Agricultural Engineering program 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 all Engineering. It also includes language subjects like Nepali and English applicable for the communication in the same area. The disciplinary subjects of Agricultural 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 Agricultural 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 Agricultural 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 describing in micro level.

Rational

Nepal is agricultural country. Main occupation of Nepalese people is agriculture, however there is very few commercial agricultures farming practice in Nepal. At present, government is focusing on commercial agriculture farming practice in the country. Different universities and CTEVT are also producing basic level, middle level and higher-level technical workforce in agriculture sector. Tribhuvan University of Nepal has commenced bachelor's level in Agricultural Engineering course in Purbanchal Campus, Dharan few years back. The diploma course of Agricultural Engineering is needed to be commenced as CTEVT is the only institution of Nepal for producing the basic and middle level technical workforce. Middle level technical workforce is highly demanded to support the higher-level technical workforce. It is believed that such technical workforce supports to commercialize the agriculture farming in the country.

Many people in the developed countries, developing countries and under developed countries have given emphasis for the broader application of Agricultural Engineering. This field has been helping the world for the development in agriculture sector and it has been creating wage and self-employment opportunities both in public and private sectors.

Curriculum Title:

Diploma in Agricultural Engineering

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

Objectives
This curriculum has following objectives to:

- Prepare technicians who are capable of undertaking works in agricultural engineering field as Agricultural Engineering Technicians for commercial agriculture farming;
- Prepare technician who are capable of undertaking works such as; Farm Structures& Infrastructure Development, Irrigation and Drainage Construction, Soil and Water Conservation, Farm Machinery Operation & Maintenance, Food Processing and Storage etc.;
- Prepare technicians who are capable of undertaking works under commercial agriculture farming, Irrigation, Rural Infrastructure Development and other civil infrastructures development related departments and sectors;
- Produce middle level competent technical workforce/human resources who can provide supervisory works of agricultural 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 Agricultural Engineering Technicians for the public and private infrastructure development sector of Nepal;
- 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 semesters]. 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 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:

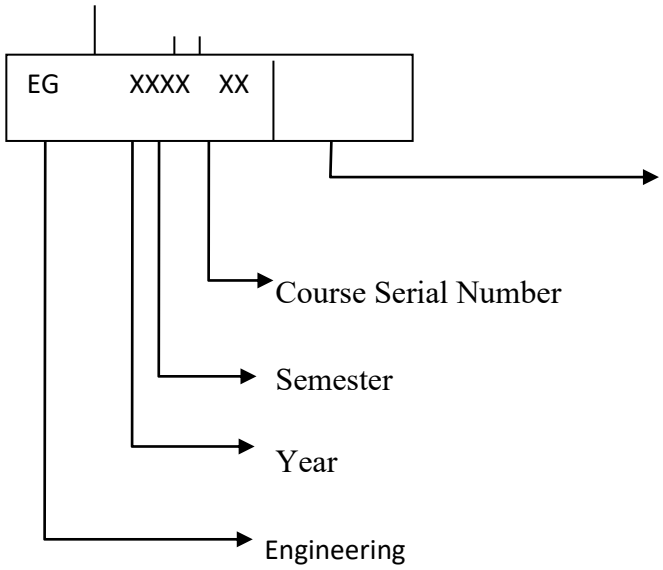
- Students who have passed all the components of all subjects of all 6 semester are considered to have successfully completed the program.
- Students who have successfully completed the program will be awarded with a degree of **"Diploma in Agricultural Engineering"**.

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:

AE: Agricultural Engineering

AR: Architecture

CE: Civil Engineering

CT: Computer Engineering

EE: Electrical Engineering

EEx: Electrical and Electronics Engineering

EX: Electronics Engineering

ME: Mechanical Engineering

MG: Management

SH: Science and Humanities

Provision of Specialization:

There will be no provision of specialization but some subjects are offered here as the elective subjects; viz Watershed Management, Farm Mechanization, Food Engineering Development and Green House Technology.

Course Structure
Diploma in Agricultural Engineering

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 1101 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 Agricultural Engineering

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 2106 CE	Engineering Materials	5			2/2	6	20	80	3	25			125	
3	EG 2107 CE	Engineering Surveying and Levelling	5		4		9	20	80	3	60	40	4	200	
4	EG 2101 ME	Machine Elements	3			2	5	20	60	3	10	10	2	100	
5	EG 2101 AE	Soil Science	3	1	2		6	20	80	3	30	20	2	150	
6	EG 2102 SH	Social Engineering	2				2	10	40	1.5				50	
7	EG 2103 CE	Fluid Mechanics and Hydraulics	3	1		2/2	5	20	80	3	25			125	
TOTAL			**24**	**3**	**6**	**4**	**37**	**130**	**500**		**150**	**70**		**850**	

YEAR: II **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 2201 EEx	Basic Electrical and Electronics Technology	4		2		6	20	80	3	30	20	2	150	*Continuous assessment
2	EG 2201 AE	Farm Structures and Construction Technology	4		3		7	20	80	3	30	20	2	150	
3	EG 2204 CE	Soil Mechanics and Foundation Engineering	4	1		2/2	6	20	80	3	25	0		125	
4	EG 2202 AE	Crop Science and Management	4		2		6	20	80	3	30	20	2	150	
5	EG 2203 AE	Post-Harvest Technology	3		2		5	20	60	3	10	10	2	100	
6	EG 2204 AE	Farm Power	4		2		6	20	80	3	30	20	2	150	
7	EG 2206 CE	Field Survey Camp			4		4	0	0		60	40	4	100	
			23	**1**	**15**	**1**	**40**	**120**	**460**		**215**	**130**		**925**	

Diploma in Agricultural Engineering

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 AE	Irrigation and Drainage Engineering	4		2		6	20	80	3	30	20	2	150	
2	EG 3102 AE	Soil and Water Conservation Engineering	3	1	2		6	20	80	3	30	20	2	150	
3	EG 3103 AE	Farm Machinery	4		2		6	20	80	3	30	20	2	150	
4	EG 3108 CE	Estimating and Costing I	3	3			6	20	80	3				100	*Continuous assessment
5	EG 3104 AE	Food processing and storage	4		2		6	20	80	3	30	20	2	150	
6	EG 3105 AE	Renewable Energy and Energy Conversion Devices	3	1	2		6	20	80	3	30	20	2	150	
7	EG 3106 AE	Project-I [Agricultural Construction Drawing with CAD]			4		4				60	40	4	100	
			21	**5**	**14**		**40**	**120**	**480**		**210**	**140**		**950**	

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 3207 CE	Construction Management	4	1			5	20	80	3				100	
2	EG 3201 AE	Agricultural Extension Education	2		1		3	10	40	1.5	25			75	
3	EG 3201 MG	Entrepreneurship Development	3		2		5	20	60	3	10	10	2	100	
4	EG 3202 AE	Rural Engineering and Infrastructure	3		2		5	20	60	3	10	10	2	100	*Continuous assessment
5	EG 3201 ME	Manufacturing Technology	3		3		6	20	80	3	30	20	2	150	
6	EG 3208 CE	Estimating and Costing II	2	2			4	20	80	3				100	
7	EG 3203 AE	Project II			6		6				60	40	4	100	
8	EG 3204 AE	Elective [One of the followings]	3		2		5	20	60	3	10	10	2	100	
		Watershed Management													
		Farm Mechanization													
		Food Engineering Development													
		Green House Technology													
			20	**3**	**16**		**39**	**130**	**460**		**145**	**90**		**825**	

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 2106 CE	Engineering Materials
3	EG 2107 CE	Engineering Surveying and Leveling
4	EG 2101 ME	Machine Elements
5	EG 2101 AE	Soil Science
6	EG 2102 SH	Social Engineering
7	EG 2103 CE	Fluid Mechanics and Hydraulics

Engineering Mathematics III
EG 2101 SH

Year: II
Semester: I

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

Evaluation Scheme

Unit wise Marks division for Final Exam

S. N.	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 PustakBhawan, 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 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.

Engineering Materials

EG 2106 CE

Year: II
Semester: I

Total: 6 Hrs./week
Lecture: 5 Hrs./week
Tutorial: Hrs./week
Practical: Hrs./week
Lab: 2/2 Hrs./week

Course Description:

This course is designed to give knowledge of different building materials, to develop and understanding the various properties, quality and uses of materials and their testing methods to determine their qualities to the students.

Course Objectives:

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

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

Course contents:

THEORY

Unit 1: Introduction to Engineering Materials [4 Hrs.]

1.1 Definition
1.2 Scope of the subject
1.2 Type of Engineering [Building] materials
1.3 Physical, Mechanical, Chemical and Thermal properties of material
1.4 Building Materials & its importance in Agricultural Engineering.
1.5 Building materials available in Nepal

Unit 2: Stone [9 Hrs.]

2.1 Introduction to stone as building units
2.2 Types of rock according to:
  2.2.1 Geological formation
    - Igneous rock
    - Sedimentary rock
    - Metamorphic rock
  2.2.2 Physical properties of stone
  2.2.3 Hardness of stones
2.3 Quarrying of stones by – Excavation, wedging and blasting
2.4 Precautions in Blasting
2.5 Seasoning and preservation of stone
2.6 Dressing of Stone
  2.6.1 Hammer dressing
  2.6.2 Chisel drafted margin
  2.6.3 Tooling and axing
  2.6.4 Fine tooling and sawing
  2.6.5 Rubbed and polished work
2.7 Methods of laying stones – Natural bed of stone; Introduction to construction techniques e.g. Random rubble masonry, random rubble coursed masonry and Ashlar masonry.
2.8 Selection and uses of Stone for Engineering Works:
  - Granite, Sandstone, Limestone, Marble & Slate.

2.9 Introduction to: Testing of stone for: -
- 2.9.1 Weathering
- 2.9.2 Durability
- 2.9.3 Water absorption and porosity
- 2.9.4 Specific gravity
- 2.9.5 Compressive strength

2.10 Characteristics of good building stone.

Unit 3: Bricks **[10 Hrs.]**

3.1 Introduction
3.2 Constituents of brick earth and their functions
3.3 Harmful constituents of brick earth
3.4 Manufacturing of brick:
- 3.4.1 Digging, weathering, blending, and tempering.
- 3.4.2Brick making process [Moulding]: Hand making process; Machine making process
- 3.4.3 Drying of moulded bricks: Natural drying and artificial drying
- 3.4.4 Burning of bricks: Intermittent kiln and continuous kiln.
- 3.4.5 Storing and Dispatching.

3.5 Classification of brick: A class, B class, C class, A^{+} Class and A^{++} Class Brick
3.6 Characteristics of Good Brick.
3.7 Tests on brick: Compressive strength, Water absorption and Efflorescence and Size.

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

4.1 Introduction
4.2 Tiles and their type: Roofing tiles, wall tiles, paving tiles
4.3 Various use of tile in construction
4.4 Physical and mechanical properties of tiles
4.5 Characteristics of good tiles

Unit 5: Lime **[4 Hrs.]**

5.1 Introduction
5.2 Constituents of lime
5.3 Classification and properties of lime: Fat lime [white lime], Lean lime and Hydraulic lime.
5.4 Setting action of lime
5.5 Slaking of lime
5.6 Use of lime: Lime plaster, lime punning, lime painting [White washing].

Unit 6: Cement **[12 Hrs.]**

6.1 Introduction
6.2 Use of cement in construction
6.3 Raw materials [ingredients] of cement
6.4 Harmful constituents of cement
6.5 Introduction to manufacturing process of cement: Wet process and dry Process
6.6 Flow diagram of wet process of manufacturing cement
6.7 Various types of cement and their properties
6.8 Storage and transportation of cement
6.9 Various admixtures
6.10 Standard tests on cement

Unit 7: Timber and Timber Products **[8 Hrs.]**

7.1 Introduction
7.2 Classification of trees

7.3 Soft wood and hard wood
7.4 Characteristics of a good timber
7.5 Defects in timber
7.6 Seasoning of timber: Objectives of seasoning, methods of seasoning, drying of logs.
7.7 Deterioration and preservation of timber.
7.8 Commercial form of timber: ply wood, laminated board, block board, hard board, fiber board.
7.9 Physical, mechanical and thermal properties of timber
7.10 Advantages and disadvantages of wood

Unit 8: Metals and Alloys **[12 Hrs.]**

8.1 Introduction
8.2 Ferrous and non-ferrous metals.
8.3 Use of different metals in construction
8.4 Short description of Ferrous metals: - pig iron, cast iron, wrought iron and steel.
8.5 Short description of Non-Ferrous metals- Aluminum
8.6 Steel: Composition, properties and uses, different types of steel and their use
8.7 Corrosion in ferrous metals and their prevention
8.8 Heat Treatment Process
8.9 Commercial product of Metals
8.10 Defects in steel
8.11 Properties of metal:
    8.11.1 Mechanical treatment of steel
    8.11.2 Elastic and plastic behavior of metals
    8.11.3 Ductility, resilience and stiffness of steel
    8.11.4 Hardness and toughness of steel
    8.11.5 Deformation of steel
    8.11.6 Stress strain relationship
    8.11.7 Modulus of elasticity and Poisson's ratio

Unit 9: Paints and Varnishes **[4 Hrs.]**

9.1 Introduction
9.2 Use of Paints and Varnishes
9.4 Use of various types of paints: Oil paint, Water paint, Cement paint and Acrylic Paints.
9.5 Preparation techniques of various paints
9.6 Methods of application of paint on various surfaces
9.7 Properties of good paint

Unit 10: Asphalt, Bitumen and Tar **[5 Hrs.]**

10.1 Introduction
10.2 Definition: Asphalt, Bitumen and Tar
10.3 Properties and use of Asphalt, Bitumen and Tar
10.4 Types of Asphalt, Bitumen and Tar
10.5 Comparison between asphalt, bitumen and tar
10.6 Test on bitumen – penetration test, softening point test, viscosity test and ductility test

Unit 11: Synthetic polymers **[2 Hrs.]**

11.1 Introduction
11.2 Basic types of polymer
11.3 Properties of polymer
11.4 Use of polymers in agricultural engineering works.

Unit 12: Miscellaneous Materials **[2 Hrs.]**

12.1 Glass [Constituents, types, properties, and use]
12.2 Plaster of Paris

12.3 Stone- ware Glazed Pipes
12.4 White washing and distempering

Practical [Laboratory]: [2/2 Hrs.]

1. Perform fineness test of cement
2. Perform consistency test of cement
3. Perform determination of initial and final setting time of cement
4. Perform compressive strength test of cement
5. Perform tensile strength test of cement
6. Perform compressive strength and water absorption test of brick
7. Perform Fineness modulus, clay & silt content and bulking of sand
8. Perform Los-Angeles Abrasion Test of Coarse aggregate
9. Perform Penetration, Ductility, Viscosity and Softening point test of Bitumen
10. Microstructure examination of mild steel, alloy steel, aluminum alloy, cast-iron and wood, using optical microscope
11. Hardness of mild steel, cast iron and alloy steel.
12. Toughness test on mild steel, cast iron and alloy steel.
13. Visit nearby Brick and/or cement factory, observe the production process and prepare report – 1 day.

References:

1. Chong, C.V.Y., [1977], Properties of materials, Mac Donalds and Evans Ltd. Estover, Plymouth, UK
2. Gupta, R. B. [1974] Material Science and Process, Stya Prakashan, Inc. Tech India Publication, New Delhi.
3. Peter A. Thornton and Vito J. Colangela Prentice “Fundamental of Engineering Materials”, Hall Publishing Company, 1985.
4. Parbin Singh “Civil Engineering Material”, Katson Books, 2008.
5. R.K. Rajput “Engineering Material”, S. Chand & Company Ltd. 2004.
6. Gurucharan Singh, Building Materials,
7. Sushil Kumar, Building Materials

Evaluation Scheme

The questions will cover all the chapters of the syllabus. The evaluation scheme will be as below:

Chapter	Hrs.	Marks distribution
1	4	4
2	9	8
3	10	12
4	3	4
5	4	4
6	12	12
7	8	8
8	12	12
9	4	4
10	5	4
11	2	4
12	2	4
Total	75	80

* There may be minor deviation in marks distribution

Engineering Surveying and Levelling
EG 2107CE

Year: II
Semester: I

Total: 9 Hrs./week
Lecture: 5 Hrs./week
Tutorial: Hrs./week
Practical: 4 Hrs./week
Lab: Hrs./week

Course Description:
The objective of this course is to introduce the students of Diploma agricultural Engineering about fundamental knowledge of land measurement and surveying techniques. Overall course is designed to make the students able to learn and apply the suitable survey procedure and equipment for producing map.

Course objective:
At the end of this course, the students will be able to

- Learn and apply the suitable survey procedure and equipment for producing map.

Course contents:

Theory

Unit 1: Introduction: [4 Hrs.]

1.1 Definition of survey
1.2 Principles used in survey
1.3 Classification of survey [types]
1.4 History of surveying.

Unit 2: Concept of errors, precision, accuracy and scale [6 Hrs.]

2.1 Unit and system of measurements, Types of measurements, significant figures, Rounding of numbers
2.2 Accuracy and precision
2.3 Errors in measurements, sources of errors, types of errors.
2.4 Scale- Introduction and types

Unit 3: Linear measurements [5 Hrs.]

3.1 Distance measurements by pace, tape, chain, Triangulation, Tachometry, EDM and their principle
3.2 Tape corrections [standardization, Tension, Temperature, Sag, Slope]

Unit 4: Levelling [10 Hrs.]

4.1 Definition, Requirement and principles of levelling.
4.2 Types of levelling [Direct/Spirit levelling, Trigonometrical levelling, Barometric levelling]
4.3 Instruments and Tools- level machine and its types levelling staffs, foot plates, etc.
4.4 Important terms of used in leveling- elevation, Reduced level, station. Back sight, Fore sight, Intermediate sight, Bench mark, Temporary bench mark, line of collimation, line of sight.
4.5 Temporary and permanent adjustment of level, collimation error, two peg test.
4.6 Booking and calculation of reduced level [HI method and Rise/Fall method]
4.7 Classification of leveling
   a. Simple levelling
   b. Fly levelling
   c. Profile levelling
   d. Cross section levelling
   e. Reciprocal levelling

4.8 Field problems

Unit 5: Compass surveying [9 Hrs.]

5.1 Introduction, definition of meridian and types. Bearing/ azimuth and its types.
5.2 Types of compass, system of bearing, conversion from one system to another.
5.3 Calculation of angles from bearing and vice versa
5.4 Errors in compass survey [local attraction, and observational error] and its adjustment
5.5 Traverse- Introduction, Types
5.6 Compass traverse
5.7 Traverse plotting

Unit 6: Theodolite surveying [12 Hrs.]

6.1 Introduction of theodolite
6.2 Construction, principle, parts of transit and theodolite.
6.3 Temporary adjustment of theodolite
6.4 axes of Theodolite
6.5 Different method of measurement of horizontal and vertical angle.
6.6 Theodolite traversing
- principle of theodolite traverse
- needs and signification of traversing
- field works for traversing, traverse field notes

6.7 Computation of closed traverse
- Balancing the angles, computation of bearings, computation of consecutive co-ordinate [latitudes and departure], balancing of consecutive co-ordinate, computing of independent co-ordinates

6.8 Plotting of traverse
6.9 Field problems and Instructions

Unit 7: Tachometry and topographic surveying [10 Hrs.]

7.1 Introduction to tachometry, instruments used in tachometry.
- Stadia rod, tachometer, levelling staff

7.2 Vertical base tachometry
- Stadia method – Principle of stadia method, Distance elevation formula for horizontal line of sight and inclined line of sight with staff vertical.
- Tangential method- Different cases

7.3 Horizontal base tachometry: Introduction to substance bar, Calculation of horizontal distance and vertical height using substance bar.
7.4 Topographic map
a. Introduction
b. Features of topographic map
c. Introduction of tachometry sheet
d. Preparation of topographic map. Using tachometry.

Unit 8: Area and volume measurement [5 Hrs.]

8.1 Definition
8.2 Area by division into simple figures.
8.3 Area by different method.
- Area by co-ordinates.
- Area by trapezoidal rules.
- Area by Simpson's ⅓rd rule.

8.4 Volume by cross section.
8.5 Volume by trapezoidal formula.
8.6 Volume by prismoidal formula.

Unit 9: Contouring **[5 Hrs.]**

9.1 Introduction, definition of contour interval.
- Horizontal equipment.
- Factors affecting contour interval.

9.2 Characteristics of contour.
9.3 Method of contouring.
9.4 Interpolation of contours.
9.5 Uses of contour Maps.

Unit 10: Curves **[6 Hrs.]**

10.1 Introduction to simple circular curve, Compound circular curve, Reverse curves, Elements of simple circular curves.
10.2 Introduction to transition curves and elements of composite curve.
10.3 Introduction to vertical curve
- Purpose and types.

Unit 11: Introduction to GPS **[1 Hr.]**

Unit 12: Introduction to photogrammetry. **[1 Hr.]**

Unit 13: Introduction to Total station and application **[1 Hr.]**

Practical: **[60 Hrs.]**

1. Perform determination of pace factor.
2. Perform ranging and measure horizontal distance by tape.
3. Perform simple leveling, fly leveling, cross section & profile and reciprocal leveling.
4. Perform compass traverse
5. Perform theodolite traverse and prepare topographic map by using tachometry.
6. Demonstrate total station.

Books, Text Books:

1. A text book of surveying, R. Agor,

References:

1. A text book of surveying, B.C. Punmia,
2. A text book of surveying, N.N. Basak,
3. A text book of surveying, K.R Arora

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	4	4
2	6	8
3	5	4
4	10	12
5	9	8
6	12	12
7	10	12
8	5	4
9	5	4
10	6	6
11	1	2
12	1	2
13	1	2
Total	**75**	**80**

* There may be minor deviation in marks distribution

Machine Elements
EG2101 ME

Year: II
Semester: I

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

Course Description:
This course deals with different machine elements required for machine tools and farm machinery related to agricultural and Mechanical Engineering.

Course objectives:
After completing this course, the students will be able to:

1. Identify and apply various types of machine elements.
2. Explain the basic machine elements.
3. Perform assembling and disassembling of fasteners.
4. Perform brazing, welding, soldering and riveting operations to produce joints.

Course Contents

Theory:

Unit 1: Introduction to Machine Elements **[1 Hr.]**

1.1 Introduction
1.2 Scope and importance

Unit 2: Fasteners/Joints/Connections **[23 Hrs.]**

2.1 Detachable joints/Temporary joints [Fasteners]
- 2.1.1. Thread: Nomenclature, Types, description and application [2 Hrs.]
- 2.1.2. Screws: Types, description and application [2 Hrs.]
- 2.1.3. Nuts and bolts: Types, description and application [2 Hrs.]
- 2.1.4. Pins and keys: Types, description and application. [2 Hrs.]

2.2 Permanent joints / semi-permanent fasteners:
- 2.2.1. Rivet Joints: [3 Hrs.]
  - Introduction
  - Riveting tools: types and materials, use and care
  - Advantages and limitations
  - Types of rivet joints and Riveting methods
- 2.2.2. Soldering [2 Hrs.]
  - Introduction
  - Application, advantages and limitations
  - Soft soldering process
  - Types of soldering iron, solders and fluxes
- 2.2.3. Welded joints [6 Hrs.]
  - Introduction
  - Welding methods: types, application
  - Arc welding: Introduction, welding principle, Advantages, application, types of joints
  - Oxyacetylene welding: Introduction, Welding principle, Advantages, application, welding technique and joints
- 2.2.4. Brazing [4 Hrs.]

- Introduction
- Brazing principle, advantages and uses
- Brazing Equipment and materials
- Brazing equipment and materials
- Brazing procedures: suitable opening, clean joint faces, correct flux, supporting the pars
- Brazing operations: Flame adjustment, Heating the workpiece, flux and filler metal application, brazing and testing of brazed joints

Unit 3: Shaft and axles **[2 Hrs.]**

3.1 Introduction
3.2 Types
3.3 Comparison between shaft & axle,
3.4 Shaft layout and axle layout, materials of shafts and axle

Unit 4: Bearing **[2 Hrs.]**

4.1Introduction
4.2Classification
4.3Selection of rolling contact bearings and journal bearings
4.4 Applications

Unit 5: Belts and Pulleys: **[2 Hrs.]**

5.1Introduction
5.2Types
5.3 Application, selection, materials

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

6.1Introduction
6.2Classification
6.3Applications
6.4 Nomenclature of spure gear and its calculations

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

7.1Introduction
7.2Types, construction, selection, Application.

Unit 8: Ropes **[1 Hr.]**

8.1Introduction
8.2 Types
8.3Wire rope fasteners
8.4 Applications

Unit 9: Power Transmission **[7 Hrs.]**

9.1Introduction
9.2 Belt drive
9.3 Gear drive
9.4Chain drive
9.5Related problems on Gear drive & Belt drive.

Unit 10: Springs **[1 Hr.]**

10.1Introduction
10.2Types and applications

Unit 11: Seals **[1 Hr.]**

11.1Introduction

11.2 Types & Applications

Unit 12: Coupling & Clutches **[1 Hr.]**

12.1 Introduction

12.2 Types and applications

Practical/Lab Experiments: **[30 Hrs.]**

1. Identify geometry of machine elements
2. Prepare specifications and perform assembling as well as disassembling of the following:
   - 2.1 Screw, thread/Nuts and bolts lab [2 Hrs.]
   - 2.2 Gear labs [2 Hrs.]
   - 2.3 Bearings lab [2 Hrs.]
   - 2.4 Belt drive lab [4 Hrs.]
   - 2.5 Chain Drive lab [3 Hrs.]
   - 2.6 Shaft and axle lab [2 Hrs.]
   - 2.7 Pin and keys lab [2 Hrs.]
   - 2.8 Coupling and clutches lab [3 Hrs.]
   - 2.9 Spring lab [2 Hrs.]
   - 2.10 Practices on welding, soldering, brazing and riveting [8 Hrs.]

Reference books:

1. A text book of Machine Design; Dr. P.C. Sharma, Dr. D.K. Agrawal, S.K.Kataria &Sons
2. Mechanical Design hand book: Peter R.N.chands,ISBN:978-0-08-097759-1,Butterworth-Heimann Publications, Uk
3. Shirley's Mechanical Engineering Design, Ninth edition, Richard G.Budynas and J.Keith Nisbett, McGraw Hill Publication, New York,ISBN:978-0-07-352928-8
4. Design of Machine Elements, V.B. Bhandari,3rd edition, published by Tata McGraw Hill Education private Limited, 7-West Patel Nagar, New Delhi 110008

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	1	28
2	23	
3	2	4
4	2	4
5	2	4
6	3	4
7	1	4
8	1	
9	7	8
10	1	4
11	1	
12	1	
Total	45	60

* There may be minor deviation in marks distribution

Soil Science
EG 2101AE

Year: II
Semester: I

Total: 6 Hrs./week
Lecture 3 Hrs./week
Tutorial: 1 Hr./week
Practical: 2 Hrs./week
Lab: Hrs./week

Course Description:
The course aims at developing fundamental knowledge of soil science such as soil, its formation and classification, physical and chemical properties.

Course Objective:
The students will be able to:

- To develop understanding about soil forming processes
- Soil as natural body/medium for storage and movement of water, gases, heat, nutrients and physical and chemical properties of soil.

Course Contents

Theory

Unit 1: Definition, Concept and Use of Soil: [2 Hrs.]

1.1. Soils in relation to agricultural production
1.2. Concepts of land and soil
1.3. Definition and concept of soil science

Unit 2: Soil Forming Factors, Processes and Classification: [12 Hrs.]

2.1. Soil forming rocks and minerals
2.2. Weathering of rocks and minerals
2.3. Soil profile: horizon designations
2.4. Morphological properties
2.5. Factors of soil formation
2.6. Major soil forming processes
2.7. Introduction and history of soil classification
2.8. Surface and sub-surface diagnostic horizons
2.9. Soil temperature regimes
2.10. Soil moisture regimes
2.11. Classification according to soil taxonomy
2.12. FAO/UNESCO system of soil classification
2.13. Soils of Nepal and their suitability for different purposes
2.14. Processes of soil survey and mapping

Unit 3: Physical Properties of Soils: [8 Hrs.]

3.1. Soil color
3.2. Mechanical composition and textural classification
3.3. Soil structure
3.4. Bulk density, particle density and porosity
3.5. Soil consistency
3.6. Soil aeration
3.7. Soil moisture

3.8. Soil heat

Unit 4: Soil Physical Properties in Relation to Plant Growth [8 Hrs.]

4.1. Soil moisture:
- 4.1.1. quantitative concepts and measurements
- 4.1.2. energy concepts and measurement
- 4.1.3. soil moisture characteristics curves
- 4.1.4. soil water movements [saturated and unsaturated]
- 4.1.5. infiltration and percolation
- 4.1.6. moisture extraction by plant roots

4.2. Soil aeration:
- 4.2.1. significance
- 4.2.2. composition
- 4.2.3. mechanism of renewal

4.3. Soil temperature:
- 4.3.1. energy balance
- 4.3.2. soil thermal properties
- 4.3.3. diurnal and seasonal variations
- 4.3.4. significance

Unit 5: Soil Chemistry and Fertility [15 Hrs.]

5.1. Soil reaction:
- 5.1.1. acidic soils
- 5.1.2. saline soils
- 5.1.3. alkali soils
- 5.1.4. soil amendments
- 5.1.5. Soil colloids and their properties

5.2. Cation and anion exchange phenomenon

5.3. Macro and secondary plant nutrients:
- 5.3.1. forms
- 5.3.2. functions
- 5.3.3. deficiency symptoms
- 5.3.4. transformation
- 5.3.5. availability to the plants

5.4. Introduction to micro nutrients and their significance in plant growth

5.5. Inorganic fertilizers:
- 5.5.1. composition
- 5.5.2. uses
- 5.5.3. behavior in soil

5.6. Soil fertility evaluation:
- 5.6.1. soil testing
- 5.6.2. plant analysis
- 5.6.3. deficiency symptoms
- 5.6.4. biological tests

5.7. Soil organic matters and organic manures

5.8. Green manuring and bio-fertilizers

Practical: **[30 Hrs.]**

1. Identify the important rocks and minerals
2. Collect and prepare of soil samples
3. Determine soil texture and consistency by feel method
4. Identify soil structure
5. Determine bulk density, particle density, total porosity and air porosity
6. Analyze Particle size by hydrometer method
7. Determine aggregate size distribution
8. Observe soil profile and find out morphological properties
9. Measurement of soil moisture by different method [metric suction, electrical conductivity, oven dry, weight and volume]
10. Observe capillary phenomenon in soil and find the rise of water level
11. Determine hydraulic conductivity of the soil
12. Determine infiltration characteristics of soil
13. Handle soil testing kit [NPK]
14. Determine organic matter in soils
15. Determine soil pH and electrical conductivity
16. Estimate available nitrogen, phosphorous and potassium
17. Identify nutrient deficiency symptoms of major crops

References:

1. Nyle C. Brady. The Nature and Properties of Soils. 10th edition. Prentice Hall of India Ltd.
2. Biswas T.D. and S.K. Mukharjee. A Textbook of Soil Science. Tata McGraw Hill Publications
3. Oswal M.C. Soil Physics; Oxford and IBH Publishing Co. New Delhi
4. Gupta. P.K. Soil, Plant, Water and Fertilizer Anlysis, Agrobios [India]

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	2	4
2	12	20
3	8	16
4	8	16
5	15	24
	45	80

* There may be minor deviation in marks distribution

Social Engineering
EG 2102 SH

Year: II
Semester: I

Total: 2 Hrs./week
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

*There may be minor deviation in marks distribution

Textbook

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

Fluid Mechanics and Hydraulics
EG 2103 CE

Year: II
Semester: I

Total: 5 Hrs. /week
Lecture: 3 Hrs./week
Tutorial: 1 hour/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. Numerical of fluid properties [1 Hr.]
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 Hrs.]

3. Computation of discharge by using continuity equation, computation of Reynold's number and identifying type of flow [2 Hrs.]
4. Application of Bernoulli's equation with and without head loss, Draw HGL, and EGL. [1 Hr.]
5. Computation of hydraulic coefficients, and discharge through orifice, venturimeter, rectangular, triangular and trapezoidal weir, mid-section method for discharge computation [3 Hrs.]
6. Computation of Shear stress, velocity and Head loss [Major and minor] computation in pipe flow [2 Hrs.]
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 Hrs.]

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	6
2	Hydrostatics	10+3=13	16
3	Hydro kinematics	5+2=7	8
4	Hydrodynamics	3+1=4	6
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

* There should be minor variation in distribution in marks.

Second Year

Fourth Semester

1. EG 2201 EEx Basic Electrical and Electronics Technology
2. EG 2201 AE Farm Structures and Construction Technology
3. EG 2204 CE Soil Mechanics and Foundation Engineering
4. EG 2202 AE Crop Science and Management
5. EG 2203 AE Post-Harvest Technology
6. EG 2204 AE Farm Power
7. EG 2206 CE Field Survey Camp

Basic Electrical and Electronics Engineering
EG 2201 EEx

Year: II
Semester: II

Total: 6 Hrs. /week
Lecture: 4 Hrs./week
Tutorial: hour/week
Practical: 2 Hrs./week
Lab: Hrs./week

Course Description:
This course focuses on familiarization of fundamental concepts in DC electrical networks and electronic devices.

Course Objectives:
After completing this course, the students will be able to:

1. Identify the basics of circuit elements and their networks
2. Understand the fundamentals of electricity and electrostatics
3. Differentiate between passive and active devices, understand their characteristics
4. Identify and explain the working principles of various semiconductor devices, relate their characteristics and applications
5. Explain the characteristics of CB, CE and CC configuration circuits and also Amplifier circuits.

Course Contents:

Unit 1: Introduction [Electric Circuit Fundamentals] [4 Hrs.]

1.1. Electric current and voltage
1.2. Circuit elements: Resistor, Inductor and Capacitor
1.3. Series and parallel circuits
1.4. Electric power and energy

Unit 2: DC Circuit Analysis: [10 Hrs.]

2.1. Ohm's law [state and application]
2.2. Kirchhoff's current and voltage laws [state and numerical]
2.3. Thevenin's theorem [state and numerical]

2.4. Nortorn's theorem [state and numerical]

2.5.Superposition theorem [state and numerical]
2.6.Maximum power transfer theorem [state and numerical]

Unit 3: Electrostatics [6 Hrs.]

3.1.Laws of electric forces
3.2.Electric field, electric fluxes and flux density
3.3.Electric potential, potential difference
3.4.Capacitors and capacitance
3.5.Series and parallel connection of capacitors
3.6.Energy stored in charged capacitor, concept of charging and discharging

Unit 4: Transformers, Motors/Generators [6 Hrs.]

4.1Construction and working principle of transformers

4.2Step up and step-down transformers and their Losses in transformers
4.3Principle of DC motor action
4.4Series, shunt and compound motors
4.5 Principle of DC Generators

Unit 5: Semiconductor Devices [6 Hrs.]

5.1 Semiconductor and its types
5.2 P and N type semiconductors and their conductivity.
5.3 PN junction diode, mechanism of current flow in PN junction, Drift
5.4 forward and reverse biased PN junction, V-I characteristics
5.5 Diode as half wave, full wave and bridge rectifier.
5.6 Zener diodes and its characteristics.

Unit 6: Introduction to Bipolar Junction transistor [BJT]: [6 Hrs.]

6.1. Concept of bipolar junction transistor, structure of PNP and NPN transistor, their symbol
6.2. Mechanism of current flow and Current relations in transistor.
6.3. Common Base [CB], Common Emitter [CE], Common Collector [CC] configuration of the transistor.
6.4. Input and output characteristics in CB and CE configurations
6.5 DC load line, operating point

Unit 7: Transistor biasing Circuits and Amplifiers [10 Hrs.]

7.1 Concept of transistor biasing and selection of operating point.
7.2 Need for stabilization of operating point.
7.3Single stage transistor amplifier circuit, a.c load line and its use in calculation of currents and voltage gain of a single stage amplifier circuit.
7.4 Two port network, h- Parameters and their significance.
7.5Calculation of current gain, voltage gain, input impedance and output impedance using h-parameter.
7.6 concept of Class A, Class B and Class C amplifier.

Unit 8: Field effect Transistors [FET] [6 Hrs.]

8.1. Construction of Junction field effect transistor [JFET] and Metal Oxide Semiconductor field effect transistor [MOSFET]
8.2. Operation and characteristics of JFET.
8.3. Operation and characteristics of MOSFET in depletion and Enhancement mode.
8.4. Comparison of FET and BJT.
8.5. FET amplifier circuit and its working principle.

Unit 9: Special Semiconductor Devices [6 Hrs.]

9.1. Light Emitting Diode [LED] and Liquid Crystal Display [LCD], characteristics and applications
9.2. Photo diode and its characteristics and applications
9.3. Photo transistor and its characteristics and applications
9.4. Optocoupler device
9.5. Hall Effect Devices and application
9.6. Solid state relays and application

Practical: [30 Hrs.]

1. Verify Ohm's law using voltmeter and ammeter.

2. Verify Kirchhoff's current and voltage laws
3. Find the Equivalent Resistance in series and parallel combination
4. Identify and operate the following instruments: Multi-meter, Cathode rays Oscilloscope [CRO], Signal generator.
5. Plot V-I characteristics for PN junction diode
6. Plot V-I characteristics of Zenor diode
7. Observe the input and output wave shape of different rectifier circuits using CRO.
8. Plot input and output characteristics different configuration of BJT
9. Plot input and output characteristics of CE amplifier circuits.

References:

1. A textbook of Electrical Technology by B.L Theraja and A.K. Theraja
2. Fundamentals of Electrical Engineering by J. B. Gupta
3. Basic Electronics and Linear Circuit by NN Bhargava and Kulshreshta, Tata McGraw Hill, New Delhi.
4. Principles of Electrical and Electronics Engineering by VK Mehta

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	4	4
2	10	16
3	6	8
4	6	8
5	6	8
6	6	8
7	10	12
8	6	8
9	6	8
	60	80

* There may be minor deviation in marks distribution

Farm Structure and Construction Technology
EG 2201 AE

Year: II
Semester: II

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

Course Description:
This course is designed to provide knowledge and skills in farm building and farm structures techniques and technology it intends to provide knowledge on preparing drawing, layout and sketches of building components as well as cattle housing, poultry housing, swine and goat housing structures. It intends to design food storage structures and prepare drawing and sketches.

Course Objective:
After completion of this course the students will be able to:
1. Identify the different components of building.
2. Follow the steps of construction systematically.
3. Acquaint the functional requirement and planning of farmstead.
4. Carryout design and modification of existing design of cattle housing and agricultural structures.

Course Contents

Theory

Part – A: Building Technology

Unit 1: Foundation **[4 Hrs.]**
- 1.1 Function and types of foundation
- 1.2 Components of foundation
- 1.3 Bearing capacity of soil
- 1.4 Methods of improving bearing capacity of soil
- 1.5 Causes of failure of foundation and its remedy
- 1.6 site exploration and its purpose

Unit 2: Brick and stone masonry **[7 Hrs.]**
- 2.1 Types of bricks and bonds
- 2.2 brick laying
- 2.3 Retaining walls
- 2.4 Causes of failure of bonding
- 2.5 Damp proofing
- 2.6 Reinforced brickwork
- 2.7 Load bearing and non -load bearing wall
- 2.8 Partition and cavity walls
- 2.9 Types of stone masonry
- 2.10 Dressing of stone
- 2.11 General principles of stone masonry
- 2.12 Cement concrete block masonry

Unit 3: Damp and water proofing **[2 Hrs.]**
- 3.1 dampness and its effect on construction work

3.2 causes and sources of dampness
3.3 materials used for damp proofing
3.4 methods of damp proofing

Unit 4: lintels and arches **[2 Hrs.]**

4.1 Types of lintels and its uses
4.2 Types of arches and methods of construction

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

5.1 Types of floors
5.2 Selection of floors and floor materials
5.3 Floor finishes

Unit 6: Stairs **[2 Hrs.]**

6.1 elements of stair
6.2 requirement of good stair
6.3 types of stair
6.4 design of stair

Unit 7: Roofs **[3 Hrs.]**

7.1 classification of roofs-flat and pitched
7.2 types of pitched roof
7.3 RCC roof
7.4 roof covering-thatch, tiles, CGI and AC sheets
7.5 selection of roof covering

Unit 8: Door and window **[4 Hrs.]**

8.1 material, size and location of door and window
8.2 door frame
8.3 types of door
8.4 types of window
8.5 fittings of door and window
8.6 ventilators

Unit 9: Finishing works **[4 Hrs.]**

9.1 Materials and design considerations for plastering
9.2 Types of paint
9.3 defects of plastering
9.4 pointing types and use
9.5 painting, white washing and distempering

Unit 10: Miscellaneous works **[6 Hrs.]**

10.1 purpose and material used for false celling
10.2 plaster of Paris works
10.3 causes and prevention of cracks in building
10.4 lighting
10.5 thermal insulation
10.6 introduction to prefab
10.7 aluminum works

Part B: Farm Structures

Unit 1: Selection and planning of structure **[2 Hrs.]**

1.1 farmstead and its importance
1.2 types of farmstead

1.3 Planning principle and layout of farmstead

Unit 2: Dairy cattle housing **[4 Hrs.]**

2.1 Functional requirement and sizing
2.2 Location and orientations
2.3 Types of dairy cattle housings
2.4 Structural details
2.5 Functional and structural requirement of milking Parlor

Unit 3: Poultry housing **[4 Hrs.]**

3.1 Functional requirement and sizing
3.2 Location and orientations
3.3 Types of poultry housings
3.4 Structural details
3.5 Structure for poultry feeding and watering

Unit 4: Swine housing **[3 Hrs.]**

4.1 Functional requirement and sizing
4.2 Location and orientations
4.3 Types of swine housing
4.4 Structural details

Unit 5: Goat and Sheep housing **[3 Hrs.]**

5.1 Functional requirement and sizing
5.2 Location and orientations
5.3 Types of Goat and Sheep housing
5.4 Structural details

Unit 6: Fish ponds **[2 Hrs.]**

6.1 Functional requirements
6.2 Constructions and maintenance of Fish ponds

Unit 7: Feed and Forage structures **[4 Hrs.]**

7.1 Bag and bulk storage structures
7.2 Silo and its types
7.3 Sizing and structural details of trench, pit and tower silo

Unit 8: Green house and poly house **[2 Hrs.]**

8.1 Purpose of green house and poly house
8.2 Types, functional requirement and constructional detail

Practical **[45 Hrs.]**

Perform the following:

1. Planning and layout of building
2. Detail drawing of a small building from measurement
3. Design and drawing of doglegged staircase
4. Structural drawing of various types of roof
5. Structural drawing of various types of floors
6. Structural drawing of various types of foundations
7. Planning design and layout of dairy cattle, poultry, swine, goat and sheep housing
8. Layout of Fish pond
9. Design, drawing and layout of pit silo and trench Silo
10. Design and drawing of baggage storage structures
11. Planning and layout of farm shed with various farm machinery and equipment
12. Planning and layout of greenhouse shed

13. Planning and layout of electrical fixtures on existing drawing
14. Preparation of master plan of Agricultural Farm
15. Layout of 3 room building as per give drawing in the field.

Reference

1. Building Construction; by B.C. Punmia, Laxmi publication
2. Building Construction; by Shusil Kumar, Laxmi publication
3. Building Construction; by Rangawala, Laxmi publication
4. Farm structures, by Barre, H.J. and Sammet L.L. John Wiley & sons Inc.
5. Farm Building Design by Neubaur L.W. Prentice Hall Inc
6. Farm Building in Punjab by A.P. Bhatnagar, Punjab Agricultural University, Publication
7. CIGR handbook of Agricultural Engineering, vol. 2, animal production and aquaculture Engineering, published by American Society of Agricultural Engineers
8. Farm building design by Neubaur L.W. Prentice- Hall Inc.
9. Farm structures by Barre, H.J. and Sammet L.L., John Wiley and Sons Inc.
10. Farm building in Panjab by A.P. Bhatnagar, Punjab Agricultural University Publications.
11. Time Saver for Architecture Data

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
A1	4	4
A2	7	8
A3	2	4
A4	2	4
A5	2	4
A6	2	4
A7	3	4
A8	4	4
A9	4	4
A10	6	8
B1	2	4
B2	4	4
B3	4	4
B4	3	4
B5	3	4
B6	2	4
B7	4	4
B8	2	4
	60	80

* There may be minor deviation in marks distribution

Soil Mechanics and Foundation Engineering

EG 2204 CE

Year: II
Semester: II

Total: 6 Hrs. /week
Lecture: 4 Hrs./week
Tutorial: 1 Hr./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 [4 Hrs.]
Unit 3: Particle size distribution and consistency Index [1 Hr.]
Unit 5: Determination of Coefficient of permeability and effective stress [2 Hrs.]
Unit 6: Calculation of Dry density, moisture content, plotting of compaction curve [2 Hrs.]
Unit 7: Coefficient of compressibility and volume change [1 Hr.]
Unit 8: Mohr column failure theory [1 Hr.]
Unit 9: Determination of Active earth & passive earth pressure by Rankine's theory [2 Hrs.]
Unit 10: Determination of Bearing capacity based on Terzaghis' bearing capacity theory [2 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 & 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. Ramkrishna 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	04
2	Basic terminology and interrelations	14	16
3	Index Properties of soil	7	08
4	Soil classification	6	08
5	Soil water and effective stress	14	16
6	Compaction	7	08
7	Consolidation	10	08
8	Shear strength of soils	9	08
9	Earth pressure theory	9	08
10	Bearing capacity	12	12
	Total	**90**	**96**

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

Crop Science and Management
[EG 2202 AE]

Year: II
Semester: II

Total: 6 Hrs. /week
Lecture: 4 hour/week
Tutorial: hour/week
Practical: 2 Hrs./week
Lab: hour/week

Course Description
This course provides basic knowledge on importance, feasibility and skill on principles and practices of agriculture science. The course introduced agriculture, agronomic crops, horticultural crops and their cultivation practices and plant protection measures.

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

- Explain the basic principles of agricultural Science
- Familiar with common agriculture terminologies
- Explain climate, cultural operations and plant nutrients management for the growth and productivity of crops.
- Describe the production techniques of major crops.
- Explain principles and practices of seed production of major crops.
- Identify the major weeds, insect pest of agricultural crops and apply the management practices.
- Develop skill in cultivation of major agricultural crops

Course Contents

Part I: Agronomy

Unit 1: Definition, Scope and Importance **[2 Hrs.]**

1.1 Definition and relationship with other sciences
1.2 Scope and importance
1.3 Classification of agronomical crops

Unit 2: Crop Physiological Processes **[4 Hrs.]**

2.1 Germination
2.2 Uptake of water and nutrients
2.3 Photosynthesis
2.4 Respiration
2.5 Transpiration
2.6 Growth
2.7 Development
2.8 Flowering
2.9 Fruiting
2.10 Senescence

Unit 3: Effect of Weather Elements on Crop Production **[3 Hrs.]**

3.1 Solar radiation
3.2 Temperature
3.3 Humidity
3.4 Wind

3.5 Rainfall
3.6 Agro-climatic requirements of major food crops
3.7 Climatic hazards and their management

Unit 4: Seeds and Seed Quality **[3 Hrs.]**

4.1 Definition of seed
4.2 Seed quality
4.3 Seed viability
4.4 Seed germination
4.5 Seed dormancy
4.6 Production of quality seed
4.7 Seed processing
4.8 Seed testing and certification

Unit 5: Maintenance of Soil Productivity **[4 Hrs.]**

5.1 Importance of soil fertility
5.2 Improvement and conservation of soil fertility
5.3 Manures and fertilizers:
  5.3.1 Nutrient content
  5.3.2 Selection
  5.3.3 Rates and methods of application in major food crops
5.4 Green manures and bio-fertilizers
5.5 Management of saline, alkaline and acidic soils

Unit 6: Cropping System **[6 Hrs.]**

6.1 Crop rotation
  6.1.1 Selection of crops in crop rotation
  6.1.2 Advantages/disadvantages in selected crop rotations
6.2 Mixed cropping
6.3 Intercropping
6.4 Relay cropping
6.5 Multiple cropping
6.6 Cropping intensity
6.7 Cropping index
6.8 Harvest index
6.9 Economic and biological yield
6.10 Farming systems

Unit 7: Weed Management **[3 Hrs.]**

7.1 Definition
7.2 Losses caused by weeds
7.3 Classification
7.4 Weed Management methods
  7.4.1 Prevention
  7.4.2 Control
  7.4.3 Eradication

Unit 8: Cultivation Practices of Major Crops **[7 Hrs.]**

8.1 Cereal Crops [Rice, Wheat, Maize]
8.2 Grain Legumes [Lentil, green gram]

8.3 Oil Seeds [Mustard, Sunflower]
8.4 Industrial Crops [Sugarcane, Jute]
8.5 Tuber Crops [Potato]

Part II: Horticulture

Unit 1: Introduction: [3 Hrs.]

1.1 Meaning, branches and scope of horticulture
1.2 Importance of horticulture
1.3 Feasibility of horticultural development in Nepal
1.4 Classification of horticultural crops

Unit 2: Physiology of Horticultural Crops [3 Hrs.]

2.1 Seed and bud dormancy
2.2 Germination- factors and processes
2.3 Juvenility- characteristics and modifications
2.4 Maturity- flowering, fruit-setting, fruit growth, fruit drop and fruit ripening
2.5 Tuber and bulb formation

Unit 3: Production of Vegetables and Spice Crops [6 Hrs.]

3.1 Classification of vegetable and spice crops
3.2 Soil and climatic factors in the production of vegetable and spice crops
3.3 Cultural practices to improve and maintain soil fertility [mulching, liming, composting, green manuring, intercropping, crop rotations, contour cropping, alley cropping, terrace farming, agro-forestry]
3.4 Principle of off-season vegetable production
3.5 Cultivation practices of following vegetable crops:
  3.5.1 Cole crops [Cauliflower/cabbage]
  3.5.2 Bulb crops [Onion]
  3.5.3 Solanaceous vegetables [tomato, chilly]
  3.5.4 Cucurbits [Cucumber]
3.6 Cultivation practices of following spice crops:
  3.6.1 Ginger
  3.6.2 Cardamom

Unit 4: Production of Fruits and Plantation Crops [6 Hrs.]

4.1 Importance and scope of fruits and plantation crops
4.2 Orchard establishment- site selection, layout, selection of crops and spices
4.3 Nursery management
4.4 Principles of sexual, asexual and micro-propagation
4.5 Orchard management- green manuring, intercropping, cover cropping, mulching, sod culture, liming, weeding, manuring, fertilization, training and pruning
4.6 Cultivation practices of following fruit crops:
  4.6.1 Tropical fruits: mango, banana
  4.6.2 Sub-tropical fruits: citrus
  4.6.3 Temperate fruits: apple
  4.6.4 Plantation crops: tea, coffee

Part-III: Insect/Pest and Disease Management:

Unit 1: Insect/Pest Management **[5 Hrs.]**

1.1 Introduction to agricultural insects and pests
1.2 Principles and methods of pest control
1.3 Management of important insects/pests of field crop, vegetable and plantation crops
1.4 Pesticides and their formulations
1.5 Methods of application of insecticides and pesticides

Unit 2: Disease Management **[5 Hrs.]**

2.1 Concept and losses caused by plant diseases
2.2 Causes of plant diseases
2.3 Important diseases of field, vegetable and plantation crops
2.4 Control measures of plant diseases

Practical: **[30 Hrs.]**

1. Identify crops and their seeds.
2. Calculate rates of fertilizer and manures and their methods of application.
3. Prepare calendar of operation for sequential cropping, triple cropping, inter-cropping and relay cropping.
4. Calculate seed rate of different crops and planting materials.
5. Perform germination, viability and purity test of seeds.
6. Collect, identify and apply the control measures of weeds
7. Calculate the rates and apply the insecticides, pesticides and fungicides
8. Conduct Training and pruning in fruit crop
9. Conduct cutting and air layering in fruit crop
10. Conduct grafting and budding in horticultural crop
11. Conduct any one cultural practice of agronomical crops.

References:

1. Sharma, K.P., K.R. Dahal and K.R. Neupane. 1991. An Introduction to Agronomy. Tribhuvan University, Institute of Agriculture and Animal Science, Rampur, Nepal.
2. Modern Techniques of Raising Field Crops by Chidda Singh. Oxford and IBH Publishing Co., New Delhi
3. Agronomy: Theory and Digest by Cheema S.S. et al. Kalyani Publishers, New Delhi
4. Crop Management by S.S. Singh, Kalyani Publishers, New Delhi
5. Horticulture: Principle and Practices by Acquaah, Prentice-Hall of India Ltd.
6. Rana, M. K. 2008. Scientific Cultivation of Vegetables. Kalyan Publishers, India.
7. Chattopadhyaya, T.K. A Text Book on Pomology. Vol I-IV. Kalyani Publisher, Ludhiana.
8. Kunte, Y.N. and K.S. Yawalker. 1991. Introduction to Principles of Fruit Growing. Agri- 284 horticulture Publication, Nagpur
9. Pokharel, R.R. 2055. Balibiruwakarogharu ra tinkoroktham. 2nd ed. Publishers
10. Panwar, V.P.S. 1995. Agricultural Insect Pests of Crops and their Control, Kalyani

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
A1	2	4
A2	4	4
A3	3	4
A4	3	4
A5	4	4
A6	6	8
A7	3	4
A8	7	8
B1	3	4
B2	3	4
B3	6	8
B4	6	8
C1	5	8
C2	5	8
	60	80

* There may be minor deviation in marks distribution

Post-Harvest Technology
EG 2203 AE

Year: II
Semester: II

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

Course Description:
This course is designed to provide knowledge and skills on various post-harvest operations. It is intended to perform and equip various post harvesting equipment and finding various parameters of food products.

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

- Acquaint and equip with different unit operations of food process industries.
- Acquaint and equip with the post-harvest technology of cereals, pulses and oilseeds with special emphasis on their equipment's.

Course Contents

Theory

Unit 1: Food processing **[5 Hrs.]**

1.1 Introduction, Scope and importance of food processing
1.2 Principles and methods of food processing
1.3 Fruits and vegetables and their products for feed food
1.4 Processing of farm Crops: oil seeds, cereals, pulses

Unit 2: Mixing **[4 Hrs.]**

2.1 Theory of solid and liquid mixing
2.2 Types of Mixers
2.3 Rates of Mixing
2.4 Mixing indices
2.5 Power requirement for mixing

Unit 3: Size reduction of foods **[8 Hrs.]**

3.1 Grain shape
3.2 Principles of size reduction
3.3 Size reduction machines
3.4 Grinders and Crushers
3.5 Rice milling [huller, Sheller, whitener]
3.6 Flour milling
3.7 Operation, power requirement and efficiency of milling

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

4.1 Theory of separation
4.2 Pneumatic and mechanical separation
4.3 Types of separators
4.4 Types of Screens
4.5 effectiveness of screens

Unit 5: Filtration **[4 Hrs.]**

5.1 Theory of Filtration
5.2 Types of filters
5.3 Constant pressure filtration
5.4 Constant rate filtration

Unit 6: Moisture content **[6 Hrs.]**

6.1 Definition, Types of moisture in food
6.2 Methods of determination of moisture content
6.3 Equilibrium moisture content
6.4 Importance and application of moisture content and EMC in food processing
6.5 Methods of determination of equilibrium moisture content
6.6 EMC curve and water activity

Unit 7: Material handling systems **[8 Hrs.]**

7.1 Introduction, advantages and importance
7.2 types of material handling systems
7.3 belt and screw conveyor [construction and working principles]
7.4 pneumatic conveyor [construction and working principles]
7.5 bucket Elevator [construction and working principles]
7.6 Design consideration
7.7 capacity and power requirement of material handling devices

Unit 8: Drying of Agricultural products **[6 Hrs.]**

8.1 Theory of Drying
8.2 Thin layer drying
8.3 deep bed drying
8.4 Drying Curve
8.5 types of dryers and their working
8.6 performance evaluation of dryers
8.7 methods of Drying Grains

Practical **[30 Hrs.]**

1. Prepare a flow and layout chart of food processing plant
2. Evaluate the performance of hammer mill
3. Evaluate the performance of attrition mill
4. Observe the separation behavior of pneumatic separation and find out the efficiency
5. Find out the mixing indices of mixers
6. Evaluate the performance of belt conveyor
7. Find out drying characteristics and determine drying constants
8. Determine the moisture content in foods
9. determine the Equilibrium Moisture Content [EMC] of food

Reference:

1. Sahay KM & Singh KK. 1994. *Unit Operation of Agricultural, Processing*. Vikas Publ. House.
2. Brennan JG, Butters JR, Cowell ND & Lilly AEI. 1990. *Food Engineering Operations*. Elsevier.
3. Earle R.L. 1985. *Unit Operations in Food Processing*. Pergamon Press.

4. Fellows P. 1988. *Food Processing Technology: Principle and Practice*. VCH Publ.
5. McCabe WL & Smith JC. 1999. *Unit Operations of Chemical Engineering*. McGraw Hill.
6. Geankoplis J Christie. 1999. *Transport Process and Unit Operations*. Allyn& Bacon.

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	5	8
2	4	4
3	8	12
4	4	4
5	4	4
6	6	8
7	8	12
8	6	8
	45	60

* There may be minor deviation in marks distribution

Farm Power
EG 2204 AE

Year: II
Semester: II

Total: 6 Hrs. /week
Lecture: 4 hour/week
Tutorial: hour/week
Practical: 2 Hrs./week
Lab: hour/week

Course Description:
This Course Covers the Different Types of Power Used in Agricultural Farm. Their Characteristics, Components involve in Power Sources and Its Maintenance. It Also Covers the Selection of Power Sources According to Implement Used

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

- Understand the concept of prime sources of farm power
- Understand the fundamental knowledge of internal combustion engines and their utilization in the Agricultural field.

Course Contents:

Unit 1: Introduction to Farm Power Sources **[4 Hrs.]**

1.1 Human Power
1.2 Animal Power
1.3 Mechanical Power
1.4 Electrical Power
1.5 Bio-Gas
1.6 Solar Wind
1.7 Micro hydro Power
1.8 Advantages and Limitations of Farm Power Resources
1.9 Hitching and Power Harness
1.10 Yoke and Harness of Draught Animal
1.11 Riding and Walking Type Machines

Unit 2: Internal Combustion Engine **[6 Hrs.]**

2.1 Introduction to Combustion Engine and Their Classification
2.2 Construction Features of IC Engine
2.3 Principles of Operation 0f IC Engine
2.4 Comparison of IC and SI Engine
2.5 Two Stroke and Four Stroke Cycle Engine
2.6 Advantage & Disadvantage of Two Stroke Cycle Over Four Stroke Cycle Engine
2.7 Engine Components, Their Constructions and Use
2.5 Firing Order and Their Selection Criteria

Unit 3: Basics of Heat Engine **[4 Hrs.]**

3.1 Bore, Stroke and Displacement
3.2 Compression Ratio
3.3 Horse Power and Its Measurement
3.4 Mean Effective Pressure
3.5 Torque
3.6 Relation of Horse Power, Speed and Torque for Engine

Unit 4: Thermodynamics of IC Engine **[2 Hrs.]**

4.1 Gas Laws
- 4.1.1 Boyle´s Law
- 4.1.2 Charle's Law
- 4.1.3 Isothermal Change
- 4.1.4 Otto and Diesel cycle

Unit 5: Multi Cylinder Engine **[2 Hrs.]**

5.1 Cylinder and Valve Arrangement
5.2 Firing Order and Firing Interval
5.3 Balance and firing Order of Multi Cylinder Engines

Unit: 6 Operating Principle and Working of Engine System **[21 Hr.]**

6.1 Valve Operating System [3 Hrs.]
- 6.1.1 Valve Arrangement
- 6.1.2 Components Involved in Valve Operation
- 6.1.3 Cam Profile and Valve Lift
- 6.1.4 Valve Timing and its setting
- 6.1.5 Valve Clearance
- 6.1.6 Valve Adjustment and Maintenance

6.2 Intake and Exhaust System [2 Hrs.]
- 6.2.1 Air Cleaning System and Types
- 6.2.2 Components Involved in Exhaust System
- 6.2.3 Maintenance of Intake and Exhaust System

6.3 Fuel Supply System [6 Hrs.]
- 6.3.1 Gasoline and Diesel Fuel
- 6.3.2 Properties of Fuels used in I.C. Engines
- 6.3.3 Calorific and Heating Values of Fuels
- 6.3.4 Octane and Cetane Rating
- 6.3.5 Combustion in Spark Ignition and Compression Ignition Engines
- 6.3.6 Air-Fuel Ratio and Mixture Requirements
- 6.3.7 Carburetion and Working Principle of Carburetor
- 6.3.8 Working Principle and Components of Diesel Fuel Supply System
- 6.3.9 Working Principle and Components of Petrol Fuel Supply System

6.4 Ignition System [2 Hrs.]
- 6.4.1 Ignition Timing
- 6.4.2 Pre-Ignition and Ignition Delays
- 6.4.3 Detonation and Knocking in I.C. Engines
- 6.4.4 Ignition Advance and Retard
- 6.4.5 Ignition Trouble Shooting and Remedies

6.5 Governor and Its Control System [2 Hrs.]
- 6.5.1 Purpose of Governor
- 6.5.2 Types and Working Principle
- 6.5.3 Stability, Hunting and Regulation
- 6.5.4 Troubles and Remedies

6.6 Cooling System [2 Hrs.]
- 6.6.1 Purpose and Types of Cooling System
- 6.6.2 Components of Air-Cooling System
- 6.6.3 Components of Pressure Water Cooling System
- 6.6.4 Corrosion and Corrosion Inhibitors
- 6.6.5 Antifreeze Mixture

6.7 Lubricating System [2 Hrs.]
- 6.7.1 Purpose of Engine Lubrication
- 6.7.2 Properties of Lubricants
- 6.7.3 Lubricating Oil Classification
- 6.7.4 Additives in Lubricating Oil and Pollution
- 6.7.5 Selection Parameters of Lubricating Oil
- 6.7.6 Components of Pressure Feed Lubrication System
- 6.7.7 Maintenance of Lubrication System

6.8 Engine Starting System [2 Hrs.]
- 6.8.1 Components of Self-Starting System
- 6.8.2 Storage Battery Maintenance
- 6.8.3 Lighting and Horn
- 6.8.4 Maintenance of Electrical System

Unit 7: Small Engines for Farm Operations [1 Hr.]

7.1 Stationary Engines for Farm Operations
7.2 Range and Availability
7.3 Selection of Engines for Farm Operations

Unit 8: Tractor and Their Power Units [17 Hrs.]

8.1 Tractor as Source of Mechanical Farm Power [2 Hrs.]
- 8.1.1 History of Development of Tractors
- 8.1.2 Features and Classification of Tractors
- 8.1.3 Ranges and Availability of Tractor, Its range & availability
- 8.1.4 Two and Four Wheeled Drive

8.2 Clutch System [2 Hrs.]
- 8.2.1 Purpose and Types of Clutch
- 8.2.2 Principle of operation & Its Functions

8.3 Transmission System [2 Hrs.]
- 8.3.1 Purpose and Types
- 8.3.2 Principle of Operation and Functions

8.4 Brake System [2 Hrs.]
- 8.4.1 Purpose and Types
- 8.4.2 Principle of Operation and functions

8.5 Differential and Final Drive [2 Hrs.]
- 8.5.1 Purpose and Types
- 8.5.2 Principle of Operation
- 8.5.3 Purpose and function of Differential lock

8.6 Steering System [2 Hrs.]
- 8.6.1Purpose and Types
- 8.6.2 Principle of Operation
- 8.6.3 Components Involved in Mechanical Steering
- 8.6.4 Adjustments: Camber, Caster, Toe-in, Toe-out, Kingpin Inclination, Tie-Rod Locking

8.7 Hydraulic System [2 Hrs.]
- 8.7.1 Purpose and Types
- 8.7.2 Hydraulic Circuit Symbols
- 8.7.3 Principle of Operation and Functions
- 8.7.4 Automatic Position and Draft Controls

8.8 Auxiliary Power Transmission and Power Outlets [1 Hr.]
- 8.8.1 P.T.O. System

8.8.2 Belt, Pulley and Drawbar - functional requirements
8.8.3 Special Power Drives for Front and Side Mounted Implements

8.9 Tyres, Tubes and Wheel Balancing [2 Hrs.]
8.9.1 Introduction
8.9.2 Construction of Pneumatic Tyre
8.9.3 Size and Ply Rating
8.9.4 Ballasting
8.9.5 Tyre Service and Maintenance

Unit 9: Power Tiller and Their Utilizations [2 Hrs.]

9.1 Purpose and Types
9.2 Range and Availability
9.3 Control Systems of Power Tillers

Unit 10: Mini- Tiller [1 Hr.]

10.1 Construction, features and Its Control System

Practical: [30 Hrs.]

1. Dismantling of an Internal Combustion Engine, Identification of Major Parts and Measurement of Basic Dimensions
2. Demonstrate the Working Principle of Two-Stroke and Four Stroke Cycle Spark Ignition and Compression Ignition Engines, Ignition Timing, Firing Interval, Firing Order and Valve Timing
3. Demonstrate the Intake and Exhaust System and Air-Cleaners
4. Demonstrate the Fuel Supply System of Compression Ignition Engines
5. Demonstrate the Fuel Supply System of Spark Ignition Engines
6. Demonstrate the Cooling System in Internal Combustion Engines
7. Demonstrate the Lubrication System in Internal Combustion Engines
8. Prepare the Engine Maintenance Schedule, Troubles and Their Remedies
9. Demonstrate the Clutch System, Components Involved and Maintenance
10. Demonstrate the Gear Box, Components Involved and Maintenance
11. Demonstrate the Differential and Final Drive, Components Involved and Maintenance Operation
12. Demonstrate the Brake System, Components Involved and Maintenance Operation
13. Demonstrate the Control Systems of Power Tillers
14. Demonstrate the Control Systems of Mini Tiller

Assignments:

From different Chapter at Least four Assignments must be assigned

1. Prepare the firing order table of five cylinders IC Engine
2. Draw the neat sketch of Cam profile of cam and measure its valve lifting height
3. Draw the neat sketch of two strokes and four stroke cycle engines and explain their working
4. Draw the neat sketch of governing system of IC engine and explain its working
5. Draw the neat sketch of differential and differential lock and explain in detail

Visit:

Visit nearby Tractor and Power Tiller dealers [To study make, model and specifications], local maintenance shop of Tractor, Power Tiller and Mini-Tiller [To observe maintenance procedure] and Prepare Its Report. [One Day Visit]

Visit nearby Local Maintenance shop of Tractor, Power Tiller and Mini-Tiller and Prepare Its Report. [One Day Visit]

References:

1. Engineering Fundamentals of the Internal Combustion Engine, Willard W. Pulkrabek, Prentice-Hall of India Pvt. Ltd., New Delhi, India.
2. Internal Combustion Engines, Ganesan, Tata McGraw-Hill Publishing Company Limited, New Delhi, India.
3. Internal Combustion Engines, M. L. Mathur and P. Sharma. Dhanpat Rai & Sons, New Delhi, India.
4. Tractors and Their Power Units, J. B. Liljedahl, P. K. Turnquist, D. W. Smith and M. Hoki, CBS Publishers and Disbuters, New Delhi, India.
5. Principles of Agricultural Engineering, Vol I, T. P. Ojha and A. M. Michael. Jain Brothers, New Delhi, India.
6. Tractors and their Power Units by J. B. Liljedahl, W. M. Carleton, P. K. Turnquist and D. W. Smith. John Wiley & Sons, New York
7. Engine and Tractor Power, 4th edition, Goering, Carroll E. and Alan C. Hansen. 2004, ASABE, St. Joseph, Michigan, USA.
8. Tractors and Crawlers by Irving Frazee and V.E. Philip.
9. Farm Tractor Maintenance and Repair by S.C. Jain and C. R. Rai, Standard Publisher Distributers 1705 B, NaiSarak Delhi- 110006

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	4	4
2	6	8
3	4	4
4	2	4
5	2	4
6	21	24
7	1	2
8	17	24
9	2	4
10	1	2
	60	80

* There may be minor deviation in marks distribution

Field Survey Camp

Year: II
Semester: II

Total: 4 Hrs. /week
Lecture: hour/week
Tutorial: hour/week
Practical: 4 Hrs./week
Lab: hour/week

Course Description:
This course is designed to equip students with hand on practice on field survey of different survey equipment. The duration of this programme should not be less than 7 days [60 Hrs.]

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

1. Provide on ample opportunity to consolidate and update their practical and theoretical knowledge in surveying with facing actual field condition and problems.
2. Provide real field-based exposure to learn and apply different surveying methods, modern surveying instruments. Computational practice, and ways of presentation of their final reports including plotting.

Course Contents:

1. **Prepare topographic map [Topographic Survey]**
   a. Horizontal and vertical control-Total station [EDM mode and Theodolite mode]
   b. Instruments for vertical control: Auto level.

- Job:
  Conduct horizontal control practice around 2 hectares of land [7 to 8 control points] with semi built up area. Traverse must be enclosed and detailed topographic survey must be conducted within the periphery of that area co-ordinate [X,Y,Z] of three traverse including detailed must be controlled by using Total Station [in Theodolite and EDM mode].

- Horizontal Control:
  2 set horizontal angles allowable difference between FL and FR observations = 180 = ± 2 × least control.

Angular accuracy= 1.5' √n
Linear accuracy= 1:1000
Plotting scale= 1:500

- Vertical control:
  Vertical Control points must be done by the levelling using auto level
  Levelling misclosure= 25√k mm
  Where k= circuit distance in Km.

2. **Perform Weir Axis survey:**
   Conduct triangulation survey for horizontal control. Conduct detailed topographic survey of bridge site area. [125m × 90m] to product topographic map. L-section, X-section.
   - Plotting scale:
     Topographic map: 1:200 or 1:500
     L-section H-scale=1:1000 V-scale=1:100
     X-section=H:V 1:200.

No. of triangulation station is not more than 6 coverage area= Upstream 75m and downstream 50m from purpose axis and side width 30m on either side of river baulk allowable angular accuracy=±1.5'√n one set horizontal angle observations with FL and FR difference of 180˚±2× least control conduct of reciprocal levelling and Fly levelling for vertical control.
Allowable accuracy=±25√k mm
K=loop distance in Km.

3. Perform Canal Alignment Survey:

Perform at least 300m road alignment survey and plot plan, L-section, X-section at standard scale.

Establish BC, MC and EC while setting out of horizontal curves and compute changes
L-section data must be taken by auto level at 15m regular interval
X-section data must be taken up to 10m left and 10m right from centre line.

- Plotting scale:
  plan=1:500

L-section H-scale 1:1000
V-scale=1:100
X-section=H and v scale 1:200

- Requirements:
  NO. of students for each group should not be more than 5 [five]
- Evaluation scheme:
- Internal assessments: Continuous assessments throughout the 7 days as well as viva for computation and plotting of traverse viva for road and bridge site survey should be taken the weightage of internal assessment will be 60% [60 marks]
- Final assessment: Each group must submit camp report in standard format. During compilation of report, data must be submitted content wise including reference sketches and standard drawings must be compiled must be presented during final viva. weightage of final assessment will be 40% [40 marks]

Third Year
[Fifth and Six Semester]

Fifth Semester

1. EG 3101 AE Irrigation and Drainage Engineering
2. EG 3102 AE Soil and Water Conservation Engineering
3. EG 3103 AE Farm Machinery
4. EG 3108 CE Estimating and Costing I
5. EG 3104 AE Food processing and storage
6. EG 3105 AE Renewable Energy and Energy Conversion Devices
7. EG 3106 AE Project-I [Agricultural Construction Drawing with CAD]

Irrigation and Drainage Engineering

EG 3101 AE

Year: III
Semester: I

Total: 6 Hrs. /week
Lecture: 4 hour/week
Tutorial: hour/week
Practical: 2 Hrs./week
Lab: hour/week

Course Description:

This subject is essential to equip the learners with the knowledge of Irrigation and drainage of agricultural lands and conservation of water for optimizing the agricultural production in the most efficient and economical way.

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. Select the required pump for a particular set of conditions

Course Contents

Unit 1: Introduction to Irrigation: [2 Hrs.]

- 1.1 Definition of Irrigation
- 1.2 History of Irrigation
- 1.3 Advantages and disadvantages of irrigation
- 1.4 Necessity and scope of Irrigation
- 1.5 Types of Irrigation

Unit 2: Sources of Irrigation Water: [5 Hrs.]

- 2.1 Wells, rivers, ponds, canals and tube wells
- 2.2 Selection of site and determination of capacity of storage reservoirs and tanks

Unit 3: Ground Water: [6 Hrs.]

- 3.1 Water bearing formation
- 3.2 Confined and unconfined aquifers
- 3.3 Static water level
- 3.4 Piezometric surface
- 3.5 Pumping water level
- 3.6 Drawdown
- 3.7 Area of influence
- 3.8 Prediction of yield in confined and unconfined aquifer
- 3.9 Well development

Unit 4: Water requirement of plants: [6 Hrs.]

- 4.1 Evaporation, measurement of evaporation by pan evaporimeter.
- 4.2 Transpiration and transpiration ratio
- 4.3 Evapotranspiration or consumptive use, seasonal consumptive use, peak period consumptive use.
- 4.4 Measurement of evapotranspiration by direct methods viz. Lysimeter experiment, Field experimental plots.

4.5 Estimation of evapotranspiration from evaporation data and climatological data [introduction only].
4.6 Water requirement:
- Net and gross irrigation requirement of crops,

4.7 Irrigation frequency and irrigation period
4.8 Estimation of irrigation depth and irrigation scheduling
4.9 Irrigation intensity
4.10 Duty, Delta and base period
4.11 Factors affecting duty and methods of improving duty
4.12 Quality of irrigation water

Unit 5: Irrigation Methods: [6 Hrs.]

5.1 Introduction to surface, subsurface, sprinkler and drip irrigation systems
5.2 Surface methods of irrigation viz. border, check basin and furrow irrigation, their basic details, characteristics, types and their adaptability
5.3 Concept of subsurface irrigation method, its importance and adaptability
5.4 Sprinkler irrigation-its adaptability and limitations, types, components, operation and maintenance of sprinkler systems
5.5 Layout and various design parameters of sprinkler irrigation system
5.6 Drip irrigation- its adaptability and limitations, types, components, operation and maintenance of sprinkler systems.
5.7 Layout and various design parameters of drip irrigation system.

Unit 6: Irrigation water measurement [3 Hrs.]

6.1 Velocity area methods
6.2 Direct discharge measurement: Notches, flumes
6.3 Volumetric flow measurement

Unit 7: Irrigation Efficiencies: [3 Hrs.]

7.1 Irrigation efficiencies: water conveyance, application, storage, distribution, water use and project efficiency
7.2 Uniformity coefficient

Unit 8: Soil Moisture Movement: [6 Hrs.]

8.1 Soil moisture measurements
8.2 Soil moisture tension
8.3 Soil moisture characteristics curves
8.4 Water infiltration and determination of infiltration rate
8.5 Saturation capacity, field capacity, wilting point, percolation, seepage
8.6 Hydraulic conductivity

Unit 9: Conveyance of Irrigation Water: [6 Hrs.]

8.7 Canals and their classification [brief description only]
9.1 Seepage from canals and field channels
9.2 Canal lining-various types, advantages and disadvantages
9.3 Introduction to various water conveyance structures and their functions e.g. flumes, tunnels, inverted siphons, flexible tubing and gated pipes
9.4 Open channels, their types, and layout and design parameters
9.5 Channel slopes, free board, hydraulic sections, most economical section
9.6 Subsurface systems of water conveyance, their components, hydraulics and layout

Unit 10: Drainage: [2 Hrs.]

10.1 Definition

10.2 Water logging
10.3 Salinity and its control
10.4 Drainage coefficient

Unit 11: Drainage Investigation & Requirements: [5 Hrs.]

11.1 Estimation of drainage requirements
11.2 Required water table depths
11.3 Lowering of water table
11.4 Drainage depths for different crops
11.5 Different types of surface and subsurface drainage systems

Unit 12: Water Lifting Devices: [7 Hrs.]

12.1 Introduction to various water lifting devices viz. manual, animal and power operated
12.2 Classification of pumps
12.3 Principle of operation of centrifugal pumps [volute and diffuser type, single stage and multistage type]
12.4 Installation, operation and maintenance of centrifugal pumps, submersible pump and vertical turbine pumps; their common troubles and remedies
12.5 Principles of operation of propeller and jet pumps, their adaptability and limitations
12.6 Criteria and procedures for selection of irrigation pumps, power requirements, efficiency and economics of irrigation pumping plants

Unit 13: Irrigation Management: [3 Hrs.]

13.1 Operation and maintenance of irrigation works
13.2 Institutional development of irrigation systems
13.3 Participatory Irrigation Management

Practical: [30 Hrs.]

1. Determine the infiltration rate of soil.
2. Measure the irrigation water in the field channels using weirs.
3. Dismantle the centrifugal pump, observe and identify the constructional features of its components and assemble it.
4. Install and operate the centrifugal pump
5. Observe the vertical turbine pump and submersible pump and locate the faults and their remedies
6. Install and operate the sprinkler irrigation system
7. Install and operate the drip irrigation system
8. Select the required pump by using characteristics curves

Text books and references:

1. Michael, A.M. Irrigation Theory and Practice. Vikash Publishing House, New Delhi.
2. S.K. Garg. Irrigation Engineering and Hydraulic Structures. Khanna Publishers, New Delhi
3. H.M. Raghunath. 1990. Ground Water. Wiley Eastern Ltd., New Delhi.

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	2	4
2	5	4
3	6	8
4	6	8
5	6	8
6	3	4
7	3	4
8	6	8
9	6	8
10	2	4
11	5	8
12	7	8
13	3	4
	60	80

* There may be minor deviation in marks distribution

Soil and Water Conservation Engineering
EG 3102 AE

Year: III
Semester: I

Total: 6 Hrs. /week
Lecture: 3 hour/week
Tutorial: 1 hour/week
Practical: 2 Hrs./week
Lab: hour/week

Course Description:
The course aims at developing fundamental knowledge on importance, mechanics of soil erosion, wind erosion, landslide, soil loss estimation and maintenance, its control measures, water conservation and its management, watershed management and institutions working in this sector.

Course Objective:
After the completion of this course, the student will be able to:
- Explain the mechanics of soil erosion, wind erosion, landslide.
- Estimate soil loss and maintenance
- Apply control measures for soil loss,
- Conserve and manage water in the ecology
- Acquaint with watershed management and institutions

Course Contents

Unit 1: Soil Conservation and Hydrology **[2 Hrs.]**
- 1.1. Introduction
- 1.2. Importance of Soil and Its Conservation
- 1.3. On-site and Off-site Consequences of Soil Erosion
- 1.4. Socio-Economic Effects of Soil Erosion in Nepal
- 1.5. Role of Agricultural Engineering in Soil Conservation and Watershed Management

Unit 2: Soil Erosion by Water **[5 Hrs.]**
- 2.1 Water Erosion Types and Factors Affecting
- 2.2 Characteristics of Raindrop and Rainfall Erosivity
- 2.3 Mechanism and Assessment of Raindrop Splash
- 2.4 Mechanics of Sheet and Rill Erosion
- 2.5 Gully Erosion Mechanism, Types and Stages
- 2.6 Stream-Bank Erosion

Unit 3: Soil Erosion by Wind **[2 Hrs.]**
- 3.1 Factors Causing Wind Erosion
- 3.2 Mechanics of Soil Movement due to Wind
- 3.3 Estimation and Prediction of Wind Erosion Rates
- 3.4 Wind Erosion Control

Unit 4: Landslide, Landslip and Mass Wasting **[2 Hrs.]**

Unit 5: Soil Loss Estimation and Monitoring **[3 Hrs.]**

5.1 Simple Visual Methods for Identifying Signs of Erosion
5.2 Universal Soil Loss Equation [USLE]:
  5.2.1 Parameters of USLE
  5.2.2 Limitations of USLE and its Applicability in Nepal
  5.2.3 Modified USLE
5.3 Soil Erosion Monitoring:
  5.3.1 Sedimentation Survey
  5.3.2 Paired Catchment Studies
  5.3.3 Run-Off and Erosion Plots

Unit 6: Soil Erosion Control and Control Measures [24 Hrs.]

6.1 Principle of Soil Erosion Control [1 Hr.]
6.2 Land Classification and Evaluation of Erosion Sensitivity [2 Hrs.]
6.3 Biological and Cultural Measures: [4 Hrs.]
  6.3.1 Tillage and Crop Rotation
  6.3.2 Contouring
  6.3.3 Strip Cropping
  6.3.4 Mulching
  6.3.5 Plantation and Seeding: Wattling, Bolstors, Jute Netting
  6.3.6 Controlled Grazing
  6.3.7 Manuring and Fertilization
6.4 Mechanical Measures: [5 Hrs.]
  6.4.1 Terracing:
    6.4.1.1 Types of Terraces
    6.4.1.2 Design of Broad Base and Bench Terraces
    6.4.1.3 Maintenance of Terrace System
  6.4.2 Bunding:
    6.4.2.1 Types of Bunds for Soil Conservation
    6.4.2.2 Design of Contour Bunds
  6.4.3 Waterways:
    6.4.3.1 Purpose of Waterways
    6.4.3.2 Design of Vegetated Waterways
6.5 Structural Measures: [10 Hrs.]
  6.5.1 Check Dams:
    6.5.1.1 Purpose and Types of Check Dams
    6.5.1.2 Design and Construction of Check Dams
    6.5.1.3 Stability Analysis of Check Dams
  6.5.2 Gully Control Structures:
    6.5.2.1 Processes, Stages and Growth of Gully
    6.5.2.2 Gully Plugging
    6.5.2.3 Design and Construction of Drop Spillway
    6.5.2.4 Design and Construction of Chute Spillway
    6.5.2.5 Design and Construction of Drop-Inlet Spillway
  6.5.3 Stream-Bank Erosion Control Structures:
    6.5.3.1 Types of Embankment
    6.5.3.2 Design and Construction of Embankments
    6.5.3.3 Types of Spurs, Jetties and Groyens
    6.5.3.4 Design of Spurs and Groyens

6.5.4 Roadside Erosion Control Structures:

6.6 Soil Conservation in Hilly Areas [2 Hrs.]

Unit 7: Water Conservation and Management in Arid and Semi-Arid Areas [3 Hrs.]

7.1 Problems of Soil and Water Management in Arid and Semi-Arid Areas
7.2 Methods of Soil Moisture Management
7.3 Systems of Water Harvesting and Recycling
7.4 Design of Farm Ponds and Conservation Ponds

Unit 8: Watershed Management [2 Hrs.]

8.1 Concept of Watershed Management
8.2 Watershed Management Planning
8.3 Objectives of Integrated Watershed Management
8.4 Sub-Watershed and Micro-Watershed Prioritization

Unit 9: Institutional Arrangement for Soil Conservation and [2 Hrs.]

9.1 Watershed Management in Nepal:
9.2 Organizational Structure
9.3 Legislation and Legal Provisions:
  9.3.1 Land Tenure
  9.3.2 Water Laws in Nepal
  9.3.3 Soil and Watershed Conservation Act, 1982
  9.3.4 Soil and Watershed Conservation Regulation, 1985
  9.3.5 Regulations Related to Protected Areas
9.4 Programs and Strategies

Practical: [30 Hrs.]

1. Calculate Rainfall Erosivity Index
2. Apply Weismeir's Nomograph and estimate Soil Erodibility
3. Calculate Soil Loss using USLE
4. Design Vegetated Waterways
5. Design Problem Solving on Bench and Broad Base Terraces
6. Design Problem Solving on Contour and Graded Bunds
7. Design Problem Solving on Check Dams
8. Design Farm Ponds of given capacity
9. Field Observation of Check Dams and Other Soil Conservation Structures
10. Field Observation on Bio-Engineering Practices of Soil Conservation

References:

i. Soil and Water Conservation Engineering by G.O. Schwab, K.K. Barnes, R.K. Frevert and T.W. Edminster. John Wiley & Sons Inc., New York.
ii. Soil and Water Conservation by Norman Hudson, B.T. Batsford Limited, London.
iii. Land and Water Management Engineering by V.V.N. Murty. Kalyani Publishers Pvt. Ltd., New Delhi.
iv. Introduction to Soil and Water Conservation Engineering by B.C. Mal. Kalyani Publishers, Pvt. Ltd., New Delhi.
v. Manual on Soil and Water Conservation Practice in India by G. Singh. Central Soil and Water Conservation, Research and Training Institute, Dehradun.
vi. Design of Small Dams. Oxford and IBH Publishing Co., New Delhi

vii. Guidelines for Watershed Management. FAO Watershed Management Field Manual No. FAO, Rome.
viii. Vegetated and Soil Treatment Measures. FAO Watershed Management Field Manual No. 13/1. FAO, Rome.
ix. Laboratory manual of soil and water conservation. AK shukla, TB khatri, KM Pandit, IAAS, Rampur.

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	2	4
2	5	8
3	2	4
4	2	4
5	3	4
6	24	44
7	3	4
8	2	4
9	2	4
	45	80

* There may be minor deviation in marks distribution

Farm Machinery
[EG 3103 AE]

Year: III
Semester: I

Total: 6 Hrs. /week
Lecture: 4 hour/week
Tutorial: hour/week
Practical: 2 Hrs./week
Lab: hour/week

Course Description:
This course covers the different types of farm implements for different operations like tillage, seeding and planting, plant protection, harvesting and threshing of crops. This course also covers the functions, characteristics and its advantages of Machineries and Implements used in agricultural land.

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

- Understand the agricultural operations like tillage, Seeding, Intercultural operation, plant protection, harvesting and threshing
- Understand the function and characteristics of farm machineries
- Manage the farm machinery

Course Contents

Unit 1: Objectives and Scope of Farm Mechanization [2 Hrs.]

1.1 Objectives of Farm Mechanization
1.2 Scope and Limitations of Mechanization
1.3 Farm Mechanization Policies and Strategies of Nepal

Unit 2: Tillage [4 Hrs.]

2.1 Definition and Objectives of Tillage
2.2 Primary and Secondary Tillage
2.3 Non-conventional Tillage
2.4 Influences of Tillage on Soil

Unit 3: Primary and Secondary Tillage Implements [12 Hrs.]

3.1 Country Plow [2 Hrs.]
  3.1.1 Introduction, Construction, Main Parts and Accessories and Attachments
3.2 Mould Board Plow [2 Hrs.]
  3.2.1 Introduction, Construction, Types, Construction and Working Principle
  3.2.2 Accessories and Attachments
  3.2.3 Forces Acting on the Plough Bottom
3.3 Disc Ploughs [2 Hrs.]
  3.3.1 Introduction, Types, Construction and Working Principle
  3.3.2 Accessories and Attachments
  3.3.3 Forces Acting on Plough Bottom
3.4 Harrows [2 Hrs.]
  3.4.1 Introduction, Types, Construction and Working Principle of Harrows
  3.4.2 Functions of Harrows
  3.4.3 Forces Acting on Disk Harrow
3.5 Rotary Tillage Tools and Implements [2 Hrs.]
  3.5.1 Introduction, Types, Construction and Working Principle of Rotavator
  3.5.2 Stirring Plough and Auger Plough
  3.5.3 Advantages and Limitations of Rotary Tillage Tools
3.6 Specialized Tillage Implements [2 Hrs.]

3.6.1 Sub-Soiler and Chisel Ploughs
3.6.2 Rider and Bund former
3.6.3 Clod Crusher and Puddler

Unit 4: Tools and Implements for Intercultural Operations [3 Hrs.]

4.1 Objectives of Intercultural Operations
4.2 Types, Construction and Working Principle of Cultivator
4.3 Types of Intercultural Tools- Shovel, Hoe, Rotary hoe etc.
4.4 Horticultural Tools and Gadgets

Unit 5: Measurement of Forces on Tillage Tools [3 Hrs.]

5.1 Dynamic Soil Properties Affecting Soil-Tool Interaction
5.2 Types of Dynamometers: spring, hydraulic, eddy current, strain-gauge
5.3 Draft, Unit-Draft and Required Horse Power

Unit 6: Seeding and Planting Machines [6 Hrs.]

6.1 Objective and Function of Seeding and Planting Machine
6.2 Methods of Seeding and Planting and their Mechanism
6.3 Types, Construction and Working Principle of Drills and Planters
6.4 Types, Construction and Working Principle Paddy Trans-planters
6.5 Seed and Fertilizer Metering Devices in Drills and Planters
6.6 Calibration and Field Adjustments in Seed Drills and Planters
6.7 Furrow Openers and Covering Devices in Drills and Planters
6.8 Sugarcane and Potato Planters
6.9 Recent Advances in Seeding and Planting Implements

Unit 7: Machines and Equipment for Plant Protection [5 Hrs.]

7.1 Objectives of Spraying and Dusting
7.2 Types of Sprayers and Dusters and their Selection
7.3 Working Principle and Components of Sprayers
7.4 Working Principle and Components of Duster
7.5 Safety in Handling Plant Protection Machines

Unit 8: Harvesting Machines [10 Hrs.]

8.1 Introduction and types of harvesting [1 Hr.]
8.2 Crop Harvesting Methods and their Mechanization [1 Hr.]
8.3 Mowers [2 Hrs.]
8.3.1 Introduction, Types, Working Principle and Constructional Details
8.3.2 Functional Parameters of Mower Cutter-bar
8.3.3 Adjustments and Balancing of Cutter-bar
8.4 Reapers [2 Hrs.]
8.4.1 Introduction, Types, Working Principle and Constructional Details
8.4.2 Reaper Windrower and Reaper-Binder
8.4.3 Adjustments and Performance
8.5 Harvesters for Other Crops [4 Hrs.]
8.5.1 Potato Digger- working principle and constructional details
8.5.2 Groundnut Harvester- working principle and constructional details
8.5.3 Sugarcane Harvester- working principle and constructional details
8.5.4 Fruit Harvesting Machinery
9.5.5 Ginger and turmeric Harvesting and Cleaning Machine

Unit 9: Threshing Machines [3 Hrs.]

9.1 Introduction of Thresher, Types, their Working Principles and Constructional Details

9.2 Threshing Mechanisms and their Mechanization
9.3 Factors Affecting Thresher Performance
9.4 Adjustments and Trouble-Shooting in Mechanical Threshers

Unit 10: Combined Harvesters [2 Hrs.]

10.1 Introduction, Classification, Construction and Functions of the Components of Grain Combines
10.2 Material Flow and Adjustments in Grain Combines
10.3 Adjustments and Trouble-Shooting in Combine Harvesters
10.4 Merit and Demerit of Combine Harvester

Unit 11: Chaff and Silage Cutters and Forage Harvesters [3 Hrs.]

11.1 Introduction, Working Principle and Constructional Details
11.2 Types of Cutter Heads
11.3 Forage Blower

Unit 12: Hill Agricultural Machinery [4 Hrs.]

12.1 Need of Hill Agricultural Machinery
12.2 Animal Drawn Tillage Implements
12.3 Animal Drawn Seed drill and Planter
12.4 Jab Seeder
12.5 Modification of Traditionally adapted Hand Tools and implements

Unit 13: Selection and Economics of Farm Machines and Equipment [3 Hrs.]

13.1 Selection Criteria of Farm Machines and Equipment
13.2 Cost of Operation of Farm Machines
13.3 Management of Farm Machines for Maximizing Performance
13.4 Feasibility of Custom Hiring of Farm Machines and Equipment

Practical: [30 Hrs.]

1. Study of Different Farm Operations and Familiarization with Farm Machines and Equipment
2. Observed and Identify the Constructional features of Animal and Tractor Drawn Mould Board Plough
3. Observed and Identify the Constructional features of Disk Plough
4. Observed and Identify the Constructional features of Animal and Tractor Drawn Disk Harrows
5. Observed and Identify the Constructional features of Rotary Tillage Tools
6. Observed and Identify the Constructional features of Sub-soiler and Chisel Plough
7. Observed and Identify the Constructional features of Mechanical Weed Control Machines and Equipment
8. Observed and Identify the Constructional features of Seeding and Planting Machines
9. Calibration of Seed Drills and Planters
10. Observed and Identify the Constructional features of Paddy Trans-planters
11. Observed and Identify the Constructional features of Potato Digger
12. Observed and Identify the Constructional features of Mechanical Threshers
13. Observed and Identify the Constructional features of Combined Harvesters
14. Observed and Identify the Constructional features of Plant Protection Machines and Equipment

Assignments:

From different Chapter at Least three Assignments must be assigned

1. Draw the neat diagram of reaper and explain its importance and working principle
2. Importance of hill agricultural machinery in Nepal
3. Important parameters of Thresher and their functions
4. Resource conservation tillage and their advantages
5. Custom hiring of farm machinery

Visit:

Visit nearby farm to observe operation of farm machinery and maintenance enter of farm machinery, prepare the report [1 Day visit]

References:

1. Principle of Farm Machinery [Latest edition] by R. A. Kepner, Roy Bainer and E. L. Barger. C & S Publishers and Distributors, New Delhi, India.
2. Farm Machinery and Equipment, 6th edition by H. P. Smith and L. H. Wilkey. Tata McGraw Hill Publishing Co. Ltd., New Delhi, India.
3. Principle of Agricultural Engineering, Vol. I [Latest Edition] by A. M. Michael and T. P. Ojha. Jain Brothers, New Delhi, India.
4. Farm Machinery, 10th edition by CludeCulpin. ELBS London, UK.
5. Elements of Farm Machines, 1st edition by A. C. Srivastava. Oxford and IBH Publishing Co. Ltd., New Delhi, India.
6. Agricultural Machines by N. I. Kelnin, I. F. Popov and A. V. A. Sakur, Amerind Publishing, New Delhi
7. Testing and Evaluation of Agricultural Machines by M. L. Mehta, S. R. Verma, S. K. Mishra and V. K. Sharma.
8. Agricultural Engineering [Through Worked Examples] by Radhey Lal and A. C. Datta. Saroj Publishers, Allahabad.

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	2	4
2	4	4
3	12	16
4	3	4
5	3	4
6	6	8
7	5	8
8	10	12
9	3	4
10	2	4
11	3	4
12	4	4
13	3	4
	60	80

* There may be minor deviation in marks distribution

Estimating and Costing I
EG 3108 CE

Year: III
Semester: I

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

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

Course Objectives:
To provide the knowledge of basic tools and methodology of estimating and costing of a construction work. After completion of this course, the students can prepare detailed estimate of Building, agricultural roads &farm Buildings and can prepare BOQ. They can also write specification of building materials and building works.

Course Contents

Theory

Unit 1: Introduction [3 Hrs.]
- 1.1 General
- 1.2 System of Units
- 1.3 Units of Measurement and Payments for different items of Works and Materials
- 1.4 Requirements of Estimating and Costing

Unit 2: Methods of Estimating [6 Hrs.]
- 2.1 Methods of Measurement of Building and Agricultural Engineering Works
- 2.2 Subheads of item of works
- 2.3 Methods of Taking out Quantities:
  - 2.3.1 Center Line Method
  - 2.3.2 Long Wall and Short Wall Method
  - 2.3.3 Crossing Method
- 2.4 Abstracting Bill of Quantities

Unit 3: Preparation of Detail Estimate [3 Hrs.]
- 3.1 Cost of Item
- 3.2 Transportation cost, other expenses and overheads
- 3.3 Contingency

Unit 4: Types of Estimates [5 Hrs.]
- 4.1 Approximate Estimate
- 4.2 Detailed Estimate
- 4.3 Revised Estimate
- 4.4 Supplementary Estimate
- 4.5 Annual Repair & Maintenance Estimate
- 4.6 Extension and Improvement Estimate
- 4.7 Complete Estimate
- 4.8 Split of Costs of Building Works

Unit 5: Analysis of Rates [8 Hrs.]
- 5.1 Introduction
- 5.2 Purpose of Rate Analysis
- 5.3 Importance of Rate Analysis
- 5.4 Requirements of Rate analysis
- 5.5 Factors affecting Rate Analysis
- 5.6 Procedure of Rate Analysis for

5.6.1 Building works
5.6.2 Water supply Works
5.6.3 Rural Road Works
5.6.4 Irrigation Works

Unit 6: Detailed Estimate **[15 Hrs.]**

6.1 Estimate for Walls
6.2 Estimate for a single room building
6.3 Estimate for a two-room building
6.4 Estimate for Earthwork in road
6.5 Estimate for RCC slab culvert
6.6 Estimate for Septic Tank and Soak pits
6.7 Estimate for Water Supply

Unit 7: Specification: **[5 Hrs.]**

7.1 Purpose of Specification
7.2 Types of Specification – General Specification and Detailed specification
7.3 Importance of Specification
7.4 Specification writing – Techniques, Use of International/Local Standards, Code of Practice.

Tutorial **[45 Hrs.]**

Estimation Assignments on following Projects:

1. A single storied residential building [6 Hrs.]
2. Rural Roads [5 Hrs.]
3. A canal fall [6 Hrs.]
4. Writing Specification of - Brickwork, RCC work, Cement, Sand, Aggregate, Steel reinforcement and Earth work. [4 Hrs.]
5. Retaining Wall [RCC, Gabion, Dry wall] [6 Hrs.]
6. Canal Lining [3 Hrs.]
7. Aqueduct, Syphon, Small Head Work [9 Hrs.]
8. Septic Tank and Soak pits [3 Hrs.]
9. Water Supply [3 Hrs.]

References:

1. Estimating and costing by BN Dutta – latest edition.
2. A text book of Estimating and Costing by G.S. Birdie – latest edition.
3. Estimating and Project Management for Small Construction Firms by Seymour Berger and Jules B. Godel - latest edition.
4. Civil Estimation, Quantity Surveying and Valuation by Amarjeet Agrawal - latest edition.
5. Biogas Support Program [BSP]'s Publications.
6. Available Agricultural Housing Tutorials.

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	3	4
2	6	12
3	3	4
4	5	8
5	8	16
6	15	28
7	5	8
	45	80

* There may be minor deviation in marks distribution

Food Processing and Storage
EG 3104 AE

Year: III
Semester: I

Total: 6 Hrs. /week
Lecture: 4 hour/week
Tutorial: hour/week
Practical: 2 Hrs./week
Lab: hour/week

Course Description:
The course aims at developing fundamental knowledge of properties of biomaterial, dairy processing, extrusion cooking, grain storage, refrigeration system and cold storage.

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

- Familiarize with properties of bio-material, dairy processing and extrusion cooking for the production of food.
- Conduct grain storage, refrigeration system and cold storage.

Course Contents

Unit 1: Properties of biomaterial **[4 Hrs.]**

1.1 Introduction
1.2 Importance and application of Geometric, Gravimetric, Optical, Electrical, Thermal, Aerodynamic, Rheological properties

Unit 2: Dairy processing: **[8 Hrs.]**

2.1 Heat Processing: [4 Hrs.]
- 2.1.1 Methods of applying heat to food Sterilization
- 2.1.2 Batch and continuous retorts, their working principle
- 2.1.3 Thermal bacteriology: TDR and TDT curve, D-value, z-value and F-value
- 2.1.4 Heat penetration curve

2.2 Deterioration in Products and their Controls: [4 Hrs.]
- 2.2.1 Physical, chemical and biological methods of food preservation
- 2.2.2 Changes undergone by the food components during processing

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

3.1 Introduction
3.2 Types of heat exchangers
3.3 Working principle of a single effect evaporation system
3.4 Heat and mass transfer in evaporator

Unit 4: Dehydration and Drying: **[7 Hrs.]**

4.1 Free moisture, bond moisture
4.2 Equilibrium moisture content
4.3 BET equation, Water activity and its estimation
4.4 Classification of driers: hot air, heated surface, microwave etc.
4.5 Tray, drum and spray, foam mat drier for liquids and pastes,
4.6 Vacuum, fluidized bed, osmotic drying: mechanism & working principles

Unit 5: Freezing: **[6Hrs.]**

5.1 Low temperature preservation
5.2 Theory of freezing
5.3 Nucleation and ice crystal growth

5.4 Freezing plateau
5.5 Calculation of freezing time by Plank's equation
5.6 IQF, Effect of freezing on product
5.7 Frozen products
5.8 Effect of frozen storage
5.9 Commercial freezers and cryogens: CO2, liquid N2

Unit 6: Freeze drying: **[4 Hrs.]**

6.1 Theory of Lyophilization
6.2 Phase diagram of water
6.3 Heat and mass transfer in freeze drying
6.4 Calculation of freeze-drying time
6.5 Freeze dried foods

Unit 7: Concentration: **[2 Hrs.]**

7.1 Theory of Concentration
7.2 Freeze Concentration
7.3 Membrane Concentration: reverse osmosis and ultra-filtration

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

8.1 Theory of irradiation, effect on foods
8.2 Microwave heating
8.3 Dielectric heating of foods

Unit 9: Introduction to Extrusion cooking **[1 Hr.]**

Unit 10: Introduction to Grain storage and its Type **[2 Hrs.]**

Unit 11: Refrigeration System **[6 Hrs.]**

11.1 Introduction
11.2 Unit of Refrigeration
11.3 Air Refrigeration System
11.4 Simple Vapour Compression Refrigeration System: Ideal and Actual Vapour Compression Cycles, T-s and p-h Diagrams, Effects of Dry Compression and Wet Compression, Coefficient of Performance
11.5 Multi-Stage Refrigeration System
11.6 Cascade Refrigeration System
11.7 Vapour Absorption Refrigeration System: Vapour Absorption Cycle,
11.8 Electrolux Refrigerator

Unit 12: Principle of Psychometrics **[8 Hrs.]**

12.1 Psychometrics properties
12.2 Psychometrics processes
  12.2.1 Sensible heating and cooling
  12.2.2 Cooling and dehumidification
  12.2.3 Heating and humidification
  12.2.4 Humidification and dehumidification
  12.2.5 Mixing of two streams of air
  12.2.6 Evaporative cooling/adiabatic humidification
12.3 Psychometric Chart and Its Use
12.4 Comfort Conditions
12.5 Air-conditioning Systems

Unit 13: Cold storage: **[6 Hrs.]**

13.1 Introduction

13.2 Functional Requirements of Cold Storage
13.3 Condition of Storage for Perishable Products
13.4 Calculation of Cooling Load
13.5 Design of Cold Storage System

Practical: **[30 Hrs.]**

1. Determine shape and size of Grains, fruits and vegetables.
2. Determine Particle density/True density, Bulk Density porosity and Specific Gravity of Food Grains.
3. Determine of Angle of Ripose and Coefficient of Internal and External Friction for Food Grains.
4. Determine Total soluble Solids [TSS] using refractometer.
5. Conduct and Experiment on Refrigeration system, Humidifier and Heat Pump to Determine Coefficient of Performance and Efficiency.
6. Visit to nearby cold storage to observe the whole system and its working mechanism and submission and presentation of report.

References:

1. C. P. Arora, "Refrigeration and Air-Conditioning", Tata McGraw Hill Book Co. Ltd, New Delhi, India.
2. Singhal OP & Samuel DVK. 2003. *Engineering Properties of Biological Materials*. Saroj Prakasan.
3. Verma R. C. & Sanjay Kr jain. *Fundamentals of Food Engineering*. Himanshu publications Udaipur.

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	4	4
2	8	12
3	4	4
4	7	8
5	6	8
6	4	4
7	2	4
8	2	4
9	1	4
10	2	
11	6	8
12	8	12
13	6	8
	60	80

* There may be minor deviation in marks distribution

Renewable Energy and Energy Conversion Devices

EG 3105 AE

Year: III
Semester: I

Total: 6 Hrs. /week
Lecture: 3 hour/week
Tutorial: 1 hour/week
Practical: 2 Hrs./week
Lab: hour/week

Course Description

This course focuses to provide fundamental knowledge to detect potential renewable energy sources and develop the skills on conversion devices

Course Objectives

After completion of the course students will be able to:

- Use locally available energy sources to fulfil farm power devices using appropriate tools and methodologies device.
- Familiarize with various Energy conversion devices.

Course Contents

Unit 1: Introduction **[3Hrs.]**

1.1 Energy resources and their classification.
1.2 Energy requirement in Agricultural production system.
1.3 Biomechanics of animal and human power harnessing.
1.4 Earth Energy cycle and energy Audit.

Unit 2: Bio Energy **[15 Hrs.]**

2.1 Introduction to biomass energy conversion.
2.2 Biomass gasification [principle and process].
2.3 Biogas characteristics and factors affecting biogas.
2.4 Consideration in biogas plant design.
2.5 Types of anaerobic digestion.
2.6 Site Definition, Classification and characteristics of Biomass.
2.7 Selection, size and construction of biogas plant.
2.8 Biodiesel
-sources of biodiesel
-chemical properties of biodiesel
-biodiesel production technology
-application of biodiesel.

Unit 3: Solar Energy **[15 Hrs.]**

3.1 solar insolation, irradiance
3.2 measurement of solar radiations
3.3 solar angles, solar time
3.4 solar energy applications
3.5 solar collectors [flat plate collector and concentrating collectors construction and working]
3.6 solar water heater
3.7 solar crop dryers
3.8 solar cooker -types and working, design considerations and performance evaluation parameters
3.9 photovoltaic conversion
3.10 solar cell materials and manufacturing process

3.11 types of solar cell
3.12 Electrical parameters of Solar cell.
3.13 principle of photovoltaic effect
3.14 solar module and arrays
3.15 components of solar photovoltaic system

Unit 4: Wind Energy **[4 Hrs.]**

4.1 Principle of wind energy conversion
4.2 Types of wind energy convertors and its characteristics.
4.3 Wind farming.
4.4 Performance and efficiency of wind mill.

Unit 5: Micro and small hydropower systems **[8 Hrs.]**

5.1 Importance of small and micro hydropower in Nepal.
5.2 Classification of water wheels and turbines.
5.3 Classification of hydropower systems.
5.4 Components of small hydropower system.
5.5 Power output and efficiency
5.6 Design considerations.
5.7 Popular micro hydroelectric systems in Nepal.
5.8 Applications on agriculture and rural development.

Practical **[30 Hrs.]**

1 Determine moisture content, Volatile matter content, fixed carbon, ash content and calorific value of biomass.
2 Compare the energy values of fuel, wood, agricultural residues, briquette and biofuel.
3 Evaluate physical and chemical properties of Biodiesel.
4 Design cattle dung based bioreactor.
5 Measurement of electrical parameter of Solar Cell.
6 Measurement of Solar Insolation by pyranometer.
7 Evaluate the performance of solar photovoltaic System.
8 Observe the operation of water lifting system by windmill and solar water pumping and report.
9 Evaluate the performance Characteristics of Turbines/peltric set.

Field Visit

Visit nearby micro hydropower, observe civil, mechanical and electrical components and submit report. one day.

References:

1. S. P. Sukahtme. Solar Energy: Principle of Thermal Collection and Storage. Tata McGraw Hill Publishing Co., New Delhi [latest edition]
2. H. P. Garg and J. Prakash. Solar Energy Fundamentals and Applications. Tata McGraw Hill Publishing Co., New Delhi [latest edition]
3. John A. Duffie and W. A. Beckman. Solar Engineering of Thermal Process. John Wiley & Sons. [latest edition]
4. R. C. Fluck and C. D. Baird. Agricultural Energetics. AVI Publishing Co. Inc. Connecticut. [latest edition - Indian/Low Cost Edition Preferred]
5. K. M. Mittal. Biomass Systems: Principle and Applications. New Age International Pvt. Ltd., New Delhi
6. B. T. Nijaguna. Biogas Technology. New Age International Pvt. Ltd., New Delhi
7. W. J. Kennedy Jr. and Wayne C. Turner. Energy Management. Prentice Hall Inc.
8. Journals of American Society of Agricultural and Biological Engineers [ASABE]

9. FAO Journals on Biomass Combustion Technologies.
10. FAO Journals on Energy Conversion and Renewable Energy for Greenhouse Heating

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	3	8
2	15	24
3	15	24
4	4	8
5	8	16
	45	80

* There may be minor deviation in marks distribution

Project-I [Agricultural Construction Drawing with CAD]

EG 3106 AE

Year: III Total: 4 Hrs. /week

Semester: I Lecture: hour/week
Tutorial: hour/week
Practical: 4 Hrs./week
Lab: hour/week

Course Description:

This course is designed to aware students using theoretical and practical application of knowledge gained during the whole course related to agricultural engineering. It contains measurement, design, drawing and estimates of components. Preparation of the report and oral presentation occurs at the end of the semester.

Course Objective:

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

- Prepare design, drawing using CAD and cost estimates of different irrigation structures.
- Prepare design, drawing using CAD and cost estimates of different soil and water conservation structures.
- Prepare design, drawing using CAD and cost estimates of farm structure and rural engineering.

The overall assignment will be as follow:

1. Irrigation : 1 Hour /week
2. Soil and Water Conservation : 1 Hour /week
3. Farm Structure and Rural Engineering : 2 Hour /week

Course Contents:

Unit 1: Irrigation:

1.1 Draw Layout of Irrigation Head Works [Cross Section]
1.2 Draw Layout, profile and cross section of small irrigation project with the help of given data/ topographic map.
1.3 Draw Layout of Drip and sprinkler Irrigation system

Unit 2: Soil and Water Conservation:

2.1 Slope stabilization using locally available material.
2.2 Soil Erosion estimation using USLE, MUSLE, RUSLE
2.3 Stream bank erosion control structures
2.4 Design, Drawing and layout of spurs.

Unit 3. Farm Structure and Rural Engineering:

3.1 Design, Drawing and estimate of cowshed having 50 cows.
3.2 Planning, Design, Drawing and estimate of goat shed having 100 goat/sheep
3.3 Planning, Design, Drawing and estimate of Green Road using Contour map.
3.4 Planning, Design, Drawing and estimate of rural water supply System
3.5 Planning, Design, Drawing and estimate of Ferro Cement tank of volume 10 cum.

Evaluation Scheme:

S.N	Subjects/Topics	Marks Distribution%	Internal%	Final%
1	Irrigation	30	18	12
2	Soil and Water Conservation	30	18	12
3	Farm Structure and Rural Engineering	40	24	16
	Total	**100**	**60**	**40**

Sixth Semester

1. EG 3207 CE Construction Management
2. EG 3201 AE Agricultural Extension Education
3. EG 3201 MG Entrepreneurship Development
4. EG 3202 AE Rural Engineering and Infrastructure
5. EG 3201 ME Manufacturing Technology
6. EG 3208 CE Estimating and Costing II
7. EG 3203 AE Project-II
8. EG 3204 AE Elective [One of the followings]
    a. Watershed Management
    b. Farm Mechanization
    c. Food Engineering Development
    d. Green House Technology

Construction Management
EG 3207 CE

Year: III
Semester: II

Total: 5 Hrs. /week
Lecture: 4 hour/week
Tutorial: 1 hour/week
Practical: Hrs./week
Lab: hour/week

Course Description:
This course gives basic knowledge on management of construction works. The course imparts basic knowledge on Procurement works, contract management, planning, scheduling and management of construction works. It also gives basic knowledge to construction site account.

Course Objectives:
The objective of the course are as follows;

- To provide basic knowledge on management of construction works
- To make able to plan and schedule of resources required in construction project.
- To provide basic knowledge of procurement/contract management
- To make able to monitor construction projects.

Course contents:

Theory

Unit 1: Introduction: [4 Hrs.]

1.1 Definition of management
1.2 Need of construction management
1.3 Function of construction management
1.4 Definition of project
1.5 Characteristics of project
1.6 Project management

Unit 2: Project planning and scheduling [10 Hrs.]

2.1 Definition of planning
2.2 Steps in planning
2.3 Importance of planning
2.4 Construction site planning
2.5 Work break down structure
2.6 Bar chart
2.7 Linked bar chart, mile stone chart
2.8 Advantages of construction schedule
2.9 Preparation of construction schedule
2.10 Material schedule
2.11 Labor schedule
2.12 Equipment schedule
2.13 Financial schedule

Unit 3: Critical Path Method [CPM] and Program Evaluation and Review Technology [PERT]. [8 Hrs.]

3.1 Introduction to CPM.
3.2 Elements of network

3.3 Network rules
3.4 Definitions of terms: Network diagram, Activity, Event, Forward pass, Backward pass, Critical path,
3.5 Determination of CP and Floats
3.6 Introduction to PERT.
3.7 Numerical on CPM

Unit 4: Contract Administration: [10 Hrs.]

4.1 Definition of Contract
4.2 Essential elements of a valid contract
4.3 Types of construction contract
4.4 Information to be given in Tender notice
4.5 Tender document
4.6 Bid-bond and Performance-bond
4.7 Contract document
4.8 Condition of contract
4.9 Supervising work of a contractor
4.10 Duties and responsibilities of site supervisor
4.11 Relation between Client, Consultant and Contractor
4.12 Site order book
4.13 Introduction to- Disputes: causes and resolution, Extension of contract, Termination of contract

Unit 5: Account [4 Hrs.]

5.1 Introduction
5.2 Types of account
5.3 Material at site
5.4 Muster Roll
5.5 Measurement book
5.6 Running bill and Final bill.
5.7 Completion report
5.8 Imprest
5.9 Administrative approval and Technical sanction
5.10 Issue rate
5.11 Indent
5.12 Stock taking
5.13 Material at site

Unit 6: Quality Control: [3 Hrs.]

6.1 Definition of Quality
6.2 Characteristics of quality
6.3 Factors affecting quality
6.4 Stage of Quality control

Unit 7: Monitoring and Control [5 Hrs.]

7.1 Introduction to monitoring
7.2 Purpose of monitoring
7.3 Introduction to control
7.4 Elements of control: Quality, Cost and Time control

Unit 8: Construction Equipment: **[6 Hrs.]**

8.1 Introduction to Construction equipment
8.2 Advantages of using construction equipment
8.3 Equipment for Earthwork
8.4 Equipment for Concrete mixing and consolidation/compaction
8.5 Equipment for Transportation and compaction
8.6 Equipment for Lifting of material and parts
8.7 Equipment for Road construction
8.8 Miscellaneous Equipment for Construction work.

Unit 9: Safety in construction: **[4 Hrs.]**

9.1 Introduction to accident
9.2 Causes of Accident
9.3 Importance of safety
9.4 Specific safety measures
9.5 Safety measures in Earth work in excavation, Scaffolding, Formwork, Blasting, Ploughing
9.6 Barricades and signals

Unit 10: Labor welfare and law: **[3 Hrs.]**

10.1 Introduction to labor welfare and law
10.2 Wages and methods of wage payment
10.3 Labor legislation

Unit 11: Maintenance management: **[3 Hrs.]**

11.1 Introduction to maintenance management
11.2 Types of maintenance
11.3 Maintenance planning and procedure
11.4 Standard Measurement Book.

Tutorials: **[15 Hrs.]**

1. Job Layout exercise
2. Practice on preparing Bar-chart
3. Numerical on CPM
4. Preparation of Tender notice
5. Preparation of Tender document

Visit nearby construction site, observe the overall site management and prepare report – 1 day.

References:

1. Adhikari R.P., Construction Management,
2. Punmia B.C, PERT and CPM,
3. Shrestha S.K, Adhikari I, A Text Book of Project Engineering,
4. Dutta B.N., Estimating and Costing,
5. Chitkara, K. K, Construction Project Management; McGraw Hill.
6. Gupta, B.L, Gupta, Amit; Construction Management and Machinary; Standard Publishers Distributors
7. Peurifoy, R L. Construction Planning, Equipment and Methods, McGraw Hill.
8. Harris, Frank, Construction Plant Excavating and Materials handling equipment and

Methods, Granada Publishing, London
9. Birdie GS, Estimating, Valuation and Specifications

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	4	4
2	10	16
3	8	8
4	10	16
5	4	4
6	3	4
7	5	8
8	6	8
9	4	4
10	3	4
11	3	4
Total	60	80

* There may be minor deviation in marks distribution

Agricultural Extension Education
EG 3201 AE

Year: III
Semester: II

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

Course Description:
The course aims at developing fundamental knowledge of education, extension education, basic learning, adult learning, rural leadership, extension delivery approach, teaching and communication in agricultural sector.

Course Objective:
After the completion of the course the students will be able to

- familiarize students with education and agricultural extension education,
- Familiarize with learning principle and adult learning
- Explain characteristics of good leader,
- Acquaint with extension delivery system for the dissemination of agricultural engineering technologies.
- Communicate well with the farmer level and stake holders.

Course Contents

Unit 1: Education and its approaches [4Hrs.]

1.1 Meaning, concept and types of education and itsobjective in national context
1.2 Formal, non-formal and informal education.

Unit 2: Extension education [4 Hrs.]

2.1 Definition
2.2 Concept
2.3 History
2.4 Philosophy
2.5 Principle
2.6 Objectives

Unit 3: Basic learning principle and adult learning [4 Hrs.]

3.1 Meaning of teaching and learning
3.2 Concepts and laws of learning
3.3 Basic learning theories and learning process
3.4 Principles of adult learning and learner's characteristics
3.5 Factors affecting adult learning and elements of effective learning.

Unit 4: Rural leadership development [4 Hrs.]

4.1 Meaning
4.2 Types of leader and leadership
4.3 Characteristics of good leader
4.4 Methods of identifying leader
4.5 Selection and development of local leaders.

Unit 5: Extension delivery system and its components [4Hrs.]

5.1 Present organization
5.2 Approach of extension delivery system in Nepal.

Unit 6: Extension teaching methods **[4 Hrs.]**

6.1 Individual method
6.2 Group method
6.3 Mass media methods.

Unit 7: Communication **[6 Hrs.]**

7.1 Concept, definition, meaning and importance of communication in extension work
7.2 Function of communication with its models
7.3 Communication channel/media
7.4 Organizational communication in agricultural development
- Audio aids
- Visual aids
- Audio-visual aids
- Other teaching aids

Practical: **[15 Hrs.]**

1. Visit the different agricultural extension organization [ADO, DLDO, NGOS Corporative] and write and submit the report.
   a) To study their organization structure, working procedure, program development and implementation, achievements and linkages
   b) Extension/ teaching methods adopted by district agriculture development office and NGOS
2. Develop audio- visual material such as poster, booklets, leaflets, flip chart, folder, wallpaper and demonstrate in the class.
3. Operate audio visual equipment [overhead projector, multimedia projector, still and movie camera]
4. Visit the rural development projects run by women development section, WDS, district development committee, DDC, rural energy development program, REDP, micro Enterprise development program, MEDP, world food program, WFP, conduct the following activities, prepare report and submit.
   a) Apply and conduct tools and techniques used in data collection: participatory rural appraisal [PRA] and focus group discussion [FGD]

References

1. Badri Bahadur Singh Dongol, Extension Education
2. SV Supe, An introduction to extension education
3. GL Ray, Extension, Communication and Management
4. Uttam Kumar Singh and AK Nayak, Extension Education

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	4	4
2	4	4
3	4	8
4	4	4
5	4	4
6	4	8
7	6	8
	30	40

* There may be minor deviation in marks distribution

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.]

1. 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

Rural Engineering and Infrastructure
EG 3202 AE

Year: III
Semester: II

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

Course Description:
This course provides students a basic knowledge about rural road, rural water supply and sanitation. It provides the students a basic concept about road planning, with special emphasis on green road, cross drainage structures & retaining structures, basic concept on geometric design, bio-engineering techniques and highway maintenance and Bridges. It deals with rural water supply design, waste management and septic tank design.

Course objective:
After completion of the course students will be able to

- Familiarize with sources of water and methods of water collection, transmission and distribution systems
- Perform tests of road construction materials
- Explain the principles of geometric design with drainage components of road
- Explain the importance and methods of wastewater and solid waste disposal

Unit 1: Introduction to Rural Engineering and Infrastructures [3 Hrs.]

1.1 Definition and scope
1.2 Rural Road construction in Nepal
1.3 water supply and sanitary systems in Nepal
1.4 Transportation System
1.5 Merits and Demerits of road transportation System

Unit 2: Rural Roads with Green Road Concepts in Nepal [18 Hrs.]

2.1 Rural Road Planning:
  2.1.1 Road Classification as per Nepal Roads Standards
  2.1.2 Approach to rural road planning
  2.1.3 Existing policies and strategies on rural roads in Nepal.
  2.1.4 Problems on road planning in Nepal
2.2 Green Road
  2.2.1 Introduction
  2.2.2 Basic principles
  2.2.3 Construction of green Roads
  2.2.4 Maintenance
2.3 Geometric design of Roads
  2.3.1 Importance of geometric design, Basic design criteria
  2.3.2 Parameters and Standards
  2.3.3 Cross sectional elements of Roads
  2.3.4 Introduction to Design speed, Camber, Super elevation, &extra widening.
  2.3.5 Pavement- types and difference between Flexible & Rigid pavement.
  2.3.6 Traffic lane capacity and sight distance

2.3.7 Curves: horizontal curves, vertical curve, simple circular Curves and transition Curves
2.3.8 Horizontal and Vertical Alignments
2.3.9 Cut and Fill using mass balance
2.3.10 Numerical on Geometric Design

2.4 Cross Drainage Structures
2.4.1 Introduction
2.4.2 Culverts [pipe, box, slab and arch Culverts]
2.4.3 Floodways and scoopers
2.4.4 Road side drainage

2.5 Bio engineering measures
2.5.1 Brief introduction to bioengineering.
2.5.2 Bioengineering Functions
2.5.3 Slope stabilization with bioengineering techniques
2.5.4 bioengineering techniques

2.6 retaining structures for roads
2.6.1 Introduction to retaining structures
2.6.1.1 Gabion walls
2.6.1.2 RCC walls
2.6.1.3 dry stone pitching
2.6.1.4 Composite Masonry walls
2.6.1.5 revetment walls

2.7 Road materials
2.7.1 Classification of road materials
2.7.2 Subgrade soil
2.7.3 Stone Aggregates
2.7.4 Bituminous material

2.8 Highway Maintenance:
2.8.1 Failure of Pavement
2.8.2 Classification of maintenance
2.8.3 Maintenance of Earth road, Gravel road, Water-bound macadam road and bituminous pavement

Unit 3: Introduction to **[3 Hrs.]**

3.1 Trial road and Trial Bridge
3.2 Suspension bridge and suspended bridge

Unit 4: Rural water Supply **[14 Hrs.]**

4.1 Introduction
4.2 Objectives of water supply
4.3 Impacts of water supply scheme
4.4 Major works in water supply scheme
4.4.1 Surface and subsurface water sources
4.4.2 Source selection criteria
4.4.3 Water demand

4.5 Population forecasting [arithmetical increase, geometrical increase and incremental increase method]
4.6 Numerical on water demand and population forecasting
4.7 Types of water impurities and their remedial measures
4.8 Water analysis and their purposes
4.9 Introduction to different treatment methods
4.9.1 Screening- coarse and fine screens
4.9.2 Sedimentation- plain sedimentation and sedimentation with coagulation

4.9.3 Introduction to filtration
4.9.4 Disinfections- Methods, Chlorination, Disinfectants residuals
4.9.5 Miscellaneous treatments-aeration and softening

4.10 Intake
4.10.1 Introduction
4.10.2 Water distribution system
4.10.3 Pipe and fittings

Unit 5: Rural Sanitation **[4 Hrs.]**

5.1 Terminologies used in sanitary engineering
5.2 System of sanitation
5.3 Wastewater disposal methods
5.4 Introduction to waste water treatments
5.5 Design of pit latrine, pour flush latrine, septic tank and soak pit

Unit 6: Solid Waste Management **[3 Hrs.]**

6.1 Collection and disposal of solid wastes
6.2 Classification of solid wastes
6.3 Solid waste disposal by landfill and composting

Practical: **[30 Hrs.]**

1. Perform impact test and flakiness index
2. Find out fineness modulus of aggregates
3. Determine PH value, dissolved oxygen, residual Chlorine of water
4. Determine the turbidity, color, total solids, total suspended and total dissolved solids of water
5. Set out simple circular curves by linear and angular method
6. Conduct one day visit nearby green road and water supply scheme and submit report

References:

1. Transportation Engineering by VN Nepal Government.
2. Water supply Engineering by Dr. P.N. Modi
3. Water Supply and Sanitation by B.C. Punmia
4. Highway Engineering by S.K. Khanna & C.E.G. Justo
5. NRS [Nepal Road Standards]
6. Principles and practices of Highway Engineering by L. R. Kadyali & N. B. Lal
7. Gravity Flow Water Supply System - GTZ, and UNICEF Publications.
8. Vazrani and SP Chandola
9. Green Road Manuals by GTZ, Nepal
10. Suspended and Suspension Bridge Manuals by HELVETAS &DOR, Nepal
11. Road side bio-engineering hand book, DOR,

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	3	4
2	18	24
3	3	4
4	14	20
5	4	4
6	3	4
	45	60

* There may be minor deviation in marks distribution

Manufacturing Technology
EG 3201 ME

Year: III | Total: 6 Hrs. /week

Semester: II

Lecture: 3 hour/week
Tutorial: hour/week
Practical: 3 Hrs./week
Lab: hour/week

Course Description:
This course deals with various types of manufacturing processes.

Course Objectives:
After completing this course, the students will be able to:

1. Apply safety rules in welding, forging, casting and machine shops.
2. Describe and perform welding methods and processes.
3. Weld the given metal pieces as per supplied drawings.
4. Assemble and disassemble oxyacetylene equipment set.
5. Perform sand casting process to produce parts as per drawing.
6. Perform hand forging operations.
7. Operate and manipulate basic machine tools and equipment used in production processes.

Course Contents:

Unit 1: Manufacturing Technology **[1 Hr.]**

1.1 Introduction
1.2 Types of manufacturing process
1.3 Safety measures in manufacturing process

Unit 2: Welding **[1 Hr.]**

2.1 Introduction
2.2 Classification of welding

Unit 3: Arc welding **[5 Hrs.]**

3.1 Introduction
3.2 Types of arc welding
3.3 Arc welding equipment & accessories
3.4 Arc welding electrodes: Classification, application and care
3.5 Arc Welding Fundamentals and techniques
3.6 Weld movement: types, application and advantages
3.7 Types of welded joints
3.8 Welding positions

Unit 4: Gas Welding [Oxyacetylene welding] **[5 Hrs.]**

4.1 Introduction
4.2 Oxyacetylene welding Principle
4.3 Advantages and application of oxyacetylene welding
4.4 Properties, uses, storage and handling of oxygen and acetylene gases
4.5 Oxy-acetylene equipment, tools and accessories:
4.6 Oxyacetylene welding and operations:
    4.6.1 Equipment set up
    4.6.2 Testing for leaks
    4.6.3 Lighting the torch and flame adjustment
    4.6.4 Shutting of equipment
    4.6.5 Running a bead with filler rods

4.6.6 Oxy-acetylene flame type, properties and uses
4.6.7 Filler rods and fluxes: classification, Selection, uses and storage

Unit 5: Resistance Welding [1 Hr.]

5.1 Introduction
5.2 Types of resistance welding
5.2.1 Spot welding
5.2.2 Seam welding
5.2.3 Projection welding

Unit 6: Foundry [4 Hrs.]

7.1 Introduction
7.2 Types of casting processes: permanent mold, Die casting, Centrifugal casting, investment casting, shell molding]
7.3 Sand Casting: Introduction, Tools, nomenclature, application, Types and properties of casting materials, Pattern Making, Core Making, Sand molding process

Unit 8: Forging [3 Hrs.]

8.1 Introduction
8.2 Hand forging tools & forging operations
8.3 Forging versus machining and casting
8.4 Forging Defects
8.5 Heat treatment of forged articles: Annealing, Normalizing, Hardening and tempering

Unit 9: Machine tools: [20 Hrs.]

9.1 Lathe [6 Hrs.]
9.1.1 Classification of Lathes and Uses
9.1.2 Components of lathe: Headstock, Carriage, Tailstock and Bed
9.1.3 Lathe accessories
9.1.4 Cutting tool: Geometry, materials and uses
9.1.5 Lathe Operations: Turning, Facing, Centre drilling, Drilling, Countersinking, Counter boring, Boring, Parting off, Threading Knurling.
9.1.6 Cutting fluids: Types, properties, functions and applications
9.2 Shaping machine [3 Hrs.]
9.2.1 Introduction
9.2.2 Classification of shaping machines
9.2.3 Basic construction, components and specifications
9.2.4 Shaping operations: Cutting a slot, Groove shaping, Machining a dovetail and cutting keyway
9.3 Milling Machine: [5 Hrs.]
9.3.1 Milling machines and accessories: types, parts and their functions
9.3.2 Milling cutters: nomenclature, type application and care
9.3.3 Milling methods: Up milling and downward milling
9.3.4 Milling operations: plain milling, angular milling, Milling of slots, keyways and Gear
9.3.5 Indexing heads: main parts and indexing [Direct and indirect]
9.4 Grinding Machine [4 Hrs.]
9.4.1 Grinding machines: Types, Main components and their functions
9.4.2 Grinding wheels: Types, specification, truing and dressing
9.5 Drilling Machine [2 Hrs.]
9.5.1 Types of drilling machine: Nomenclature, functions
9.5.1.1 Bench Drilling Machine
9.5.1.2 Pillar Drilling Machine
9.5.1.3 Radial Drilling Machine

9.5.2 Drill bits: nomenclature, types, application and care
9.5.3 Drilling operations: Drilling, Counter boring and counter sinking

Unit 10: Numerical Control of Machine tools **[4 Hrs.]**

10.1 Introduction
10.2 Procedure for manufacturing through NC
10.3 The NC machine tool systems
10.4 Tool positioning system
10.5 Motion control systems
10.6 Interpolations
10.7 Feedback devices
10.8 Transducers, sensors and convertor
10.9 Servo control systems
10.10 Classification of NC system
10.11 Applications, advantages and disadvantages of using NC machines
10.12 Types of Numerical controls: Conventional numerical control [NC], Computer numerical control [CNC], Direct numerical control [DNC]

Practical: **[45 Hrs.]**

Practical I: Welding **[10 Hrs.]**

1.1 Arc Welding [6 Hrs.]
1.1.1 Identify and handle arc welding equipment and accessories
1.1.2 Perform arc welding operations:
1.1.2.1 Striking an arc on given plates.
1.1.2.2 Padding [Beading] on flat surfaces.
1.1.3 Perform joining operations: butt, lap, T, edged and corner joints on flat Positions
1.1.4 Perform Arc cutting operation

1.2 Gas welding practical [4 Hrs.]
1.2.1 Handle gas welding equipment and accessories
1.2.2 Perform oxy acetylene welding operations:
1.2.2.1 Lining without filler rod
1.2.2.2 Lining with filler rod
1.2.2.3 Butt joint, Lap joint, T-joint, corner joint, Edge joint
1.2.3 Perform Gas cutting operation

Practical II: Casting/Foundry **[5Hrs.]**

2.1 Moulding
2.1.1 Prepare moulds of sand for solid and split patterns with core.
2.1.2 Perform casting on sand mould.
2.1.3 Perform casting on permanent mould

Practical III: Forging **[4Hrs.]**

3.1 Identify with hand forging tools, accessories
3.2 Perform forging operations: Drawing, upsetting, bending, twisting, cutting, fullering, swaging and punching
3.3 Perform heat treatments of forged parts.

Practical IV: Machining **[26 Hrs.]**

4.1 Lathe practice: [12 Hrs.]
4.1.1 Identify main components of lathe
4.1.2 Select and set cutting variables: speed, feed, and depth of cut
4.1.3 Perform lathe operations: turning, facing, center drilling, drilling, thread cutting, knurling, boring, chamfering, parting off, counter sinking, counter boring etc.

4.2 Shaping practice: [4 Hrs.]
4.2.1 Identify main parts of shaping machine

4.2.2 Adjust and set stroke length, stroke position, feed and depth of cut
4.2.3 Perform shaping operations: shaping of flat surface, slot cutting and angular shaping

4.3 Milling practice: [4 Hrs.]
4.3.1 Identify main components of milling machine
4.3.2 Select cutting variables: cutting speed, feed and depth of cut
4.3.3 Select and mount milling cutters and perform plain milling, angular milling, slot cutting, gear cutting operations
4.3.4 Select indexing head for indexing

4.4 Grinding practice: [3 Hrs.]
4.4.1 Identify main components of Grinders
4.4.2 Perform bench, pedestal and surface grinding operations
4.4.3 Grinding of single point HSS cutting tool

4.5 Drilling practice: [3 Hrs.]
4.5.1 Identify types of drilling machines and their components
4.5.2 Identify drill bits
4.5.3 Perform drilling operations: drilling, countersinking and counter boring, tapping

Reference books:

1. Elements of workshop Technology Vol.1 Manufacturing process- S. K. Hajra Chaudhary, A.K. Hajra Chaudhary-media promoter & publishers Pvt. Ltd.,20-g Sleater Road, Seervai building 'B' Bombay-400 007-2005 A.D. 14th Edition
2. Elements of workshop Technology Vol.2 Manufacturing process-S.K. Hajra, Chaudhary, A.K. Hajra Chaudhary-media promoter & publishers Pvt. Ltd., 20-g Sleater Road, Seervai building 'B' Bombay-400 007-2005 A.D. 14th Edition
3. A Text book of Workshop Technology [Manufacturing Processes] R.S. Khurmi, J.K. Gupta, Nirja publications and Printers[P]Ltd., Plot No. B-13, Mini Industrial Area, Kiccha Bypass Road, Rudrapur-263153, Udham Singh Nagar, Uttrakhand,19th Edition
4. A course in Workshop Technology, Vol.1-Prof. B.S. Raghuwanshi, Dhanpat Rai and Co.[P]Ltd. Delhi, India 9th Edition,2002
5. A course in Workshop Technology, Vol.2, Prof. B.S. Raghuwanshi, Dhanpat Rai and Co.[P]Ltd. Delhi, India 9th Edition,2002
6. A Text book of Production Technology [Manufacturing Processes], P.C. Sharma, S. Chand and Company Ltd.New Delhi, India,2nd Edition 1999
7. Manufacturing Technology, Foundry, Forming and Welding –P.N. Rao-Tata McGraw Hill Publishing Company Limited, New Delhi, India, 2nd Edition 1998

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	1	4
2	1	
3	5	8
4	5	8
5	1	4
6	1	
7	4	8
8	3	4
9	20	36
10	4	8
	45	80

* There may be minor deviation in marks distribution

Estimating and Costing II

EG 3208 CE

Year: III
Semester: II

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

Course Description:

This course focuses on familiarization of estimating and costing and specifications of farmstead, biogas plant, drip and sprinkle irrigation works.

Course Objectives:

To enable the student to estimate and acquire the knowledge on various aspects in farmstead like dairy barns, barn for poultry, compost pit, fodder silos, farm fencing, grain storage structures, silos.

Course Contents

Theory

Unit 1: Farmstead Construction [10 Hrs.]

1.1 Terms use in farmstead construction
1.2 Method of estimating of farmstead construction
1.3 Prepare a detailed estimate
  1.3.1 Dairy barn
  1.3.2 Poultry barn
  1.3.3 Goat barn
  1.3.4 Swine barn

Unit 2: Biogas plant construction: [4 Hrs.]

2.1 Terms use in Biogas plant
2.2 Different size and capacity of biogas plant
2.3 Method of estimating of different parts of biogas plant
2.4 Prepare a detailed estimate of biogas plant [4 cum capacity]

Unit 3: Farm pond and compost pit: [3 Hrs.]

3.1 Different types of farm pond and compost pit
3.2 lining of farm pond
3.3 Calculate the volume of earthwork using prismoidal formula
3.4 Prepare a detailed estimate and abstract of cost of small farm pond

Unit 4: Green House Construction: [4 Hrs.]

4.1 Terms use in Green House
4.2 Different size and capacity of Green House
4.3 Method of estimating of different parts of Green House
4.4 Prepare a detailed estimate of Green House [60 sqm capacity]

Unit 5: Cold storage and Go down Construction [5 Hrs.]

5.1 Terms use in Cold Storage and Go Down
5.2 Different size and capacity of Cold Storage and Go Down
5.3 Method of estimating of different parts of Cold Storage and Go Down
5.4 Prepare a detailed estimate of Cold Storage [100 sqm] and Go Down [500 sqm capacity]

Unit 6: Drip and Sprinkler Irrigation **[4 Hrs.]**

6.1 Terms use in Drip and Sprinkler Irrigation
6.2 Different size and capacity of Drip and Sprinkler Irrigation
6.3 Method of estimating of different parts of Drip and Sprinkler Irrigation
6.4 Prepare a detailed estimate of Drip Irrigation [20 sqm] and Sprinkler Irrigation [30 sqm capacity]

Tutorial **[30 Hrs.]**

1. Animal Housing [Cattle, Swine, Goat, Poultry] [10 Hrs.]
2. A Biogas Plant [3 Hrs.]
3. Farm Pond [3 Hrs.]
4. Green House [3 Hrs.]
5. Cold storage [4 Hrs.]
6. Go Down [4 Hrs.]
7. Drip and Sprinkler Irrigation [3 Hrs.]

Evaluation Scheme

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

Chapter	Hrs. [L + T]	Marks distribution
1	10 + 10	24
2	4 + 3	8
3	3 + 3	8
4	4 + 3	12
5	5 + 8	16
6	4 + 3	12
	60	80

* There may be minor deviation in marks distribution

Project-II
[EG 3203 AE]

Year: III
Semester: II

Total: 6 Hrs. /week
Lecture: hour/week
Tutorial: hour/week
Practical: 6 Hrs./week
Lab: hour/week

Course Description:
This course is designed to aware students using theoretical and practical application of knowledge gained during the whole course related to agricultural engineering. It contains measurement, design, drawing and estimates of components. Preparation of the report and oral presentation occurs at the end of the semester.

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

- Prepare design, drawing using CAD and cost estimates of different Farm Machinery.
- Prepare design, drawing using CAD and cost estimates of different Renewable Energy Devices.
- Prepare design, drawing using CAD and cost estimates of Food Processing.

The overall assignment will be as follow:

1. Farm Machinery : 2 Hour /week
2. Renewable Energy Devices : 2 Hour /week
3. Food Processing : 2 Hour /week

Course Content:

Unit 1: Farm Machinery

1.1 Design, draw and estimate of Animal drawn seed drill.
1.2 Design, draw and estimate of Multi row seed planter
1.3 Design, draw and estimate of wetland weeder.

Unit 2: Renewable Energy Devices

2.1 Draw Layout of Micro Hydro power schemes
2.2 Design a standalone solar photovoltaic system for 50 houses.
2.3Design, draw and layout of Biogas plant of volume 6 cum.

Unit 3: Food Processing

3.1 Design, Draw and estimate a community based cold storage of capacity 10 tons.
3.2 Design and draw baggage storage structure of capacity 500 tons.

Evaluation Scheme:

S.N	Subjects/Topics	Marks Distribution%	Internal%	Final%
1	Farm Machinery	40	24	16
2	Renewable Energy Devices	30	18	12
3	Food Processing	30	18	12
	Total	**100**	**60**	**40**

Watershed Management
EG 3204 AE [Elective]

Year: III
Semester: II

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

Course Description:
This course is aimed to equip the learners with knowledge and skill required for taking effective measures against watershed degradation economically and effectively.

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

1. Delineate the watershed boundary
2. Interpret and can use the land capability maps
3. Estimate the watershed yield
4. Plan the works for watershed management
5. Acquaint with rainwater harvesting technologies

Course Contents

Unit 1: Introduction to Watershed and Management **[7 Hrs.]**

1.1 Definitions
1.2 Watershed features
1.3 Significance of watershed
1.4 Geomorphological Characteristics of Watershed
1.5 Problems and Prospects in Watershed Management
1.6 Watershed drainage divide
1.7 Watershed Classification
1.8 Delineation of Watershed Boundary

Unit 2: Land Capability Classification **[6 Hrs.]**

2.1 Definition
2.2 Classification
2.3 Impact on watershed due to land use
2.4 Interpretation and use of land capability maps

Unit 3: Runoff and Water Yield of Watershed **[6 Hrs.]**

3.1 Runoff process
3.2 Runoff measurement- velocity, area and slope area methods
3.3 Runoff measuring devices- notch, orifice, flume
3.4 Runoff estimation by Rational method
3.5 Stage discharge relationship
3.6 Estimation of watershed yield

Unit 4: Sedimentation and its control **[7 Hrs.]**

4.1 Sediments
4.2 Sediment transport in stream flow
4.3 Types of sediment load

4.4 Assessment of sediments load:
- Types of sediment samplers
- Location and frequency of sampling
- Estimation of sediment yield of watershed

4.5 Pre-constructive and Post-Constructive measures for sediment Control

Unit 5: Land Degradation [5 Hrs.]

5.1 Definition of land degradation
5.2 Causes of land degradation:
- Natural causes
- Manmade causes

5.3 Forms of land degradation
- Physical degradation
- Productivity loss
- Vegetation degradation

Unit 6: Watershed Management and Planning [8 Hrs.]

6.1 Watershed Management Principles
6.2 Watershed Management Objectives
6.3 Factors affecting Watershed Management
6.4 Participatory Watershed Management
6.5 Community Watershed Management
6.6 Watershed Management Practices
6.7 Integrated Watershed Management Planning [IWMP]
6.8 Steps in the Watershed Management Planning
6.9 Data needs for Watershed Management plan:
- Hydro-meteorological data
- Geological and Geomorphological data
- Agricultural Data
- Socio-economic data

Unit 7: Rainwater Conservation Technologies and Rainwater Harvesting [6 Hrs.]

7.1 In-Situ Rainwater Conservation Techniques with advantages
- Rain Water Harvesting
- Roof Water Harvesting

7.2 Rainwater Conservation through Storage
7.3 Water harvesting techniques

Practical: [30 Hrs.]

1. Delineate the watershed boundary using topographical maps and aerial photographs and determination of geographical characteristics of watershed
2. Prepare the slope map
3. Collect data from hydro- meteorological station and analyze for watershed status
4. Compile the geological, hydrological, meteorological, land system, land use, soil, agricultural and socio- economic information of a watershed and report
5. Design Socio- economic questionnaire and survey
6. Visit and observe an area of soil-water conservation and prepare report and submit.

References

1. Suresh R. Soil and Water Conservation Engineering.2002. Standard Publishers and Distributors, New Delhi
2. V.V Dhruva Narayana, G. Shastri and U.S. Patnaik. Watershed management. Indian Council of Agricultural Research [ICAR]
3. G. Singh, C. Venkataraman. G. Shastri and B.P. joshi. Manual of soil and water Conservation practices. Oxford and IBH publishing Co. Ltd. New Delhi
4. Tideman E.M. 1999.Watershed Management [Guideline for Indian Conditions]. Omega publishing house, New Delhi.

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	7	8
2	6	8
3	6	8
4	7	8
5	5	8
6	8	12
7	6	8
	45	60

* There may be minor deviation in marks distribution

Farm Mechanization
EG 3204 AE [Elective]

Year: III
Semester: II

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

Course Description:
This course covers the policy of mechanization, design of machinery, its testing and custom hiring businessmen and management.

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

- Understand the method of design farm machines
- Development and modification of farm machines
- Test the Machinery applying Testing code procedure.

Course Contents

Theory

Unit 1: Farm Mechanization Policy and Strategies of Nepal [3 Hrs.]

1.1 Government Policy and Status of Mechanization of Nepal
1.2 Sustainable Agricultural Mechanization
1.3 Key role Player in Farm Mechanization
1.4 Role of Farm Machinery Design in Farm Mechanization

Unit 2: Design Parameters and Procedure [4 Hrs.]

2.1 Design Parameters [2 Hrs.]
- 2.1.1 Principles of Agricultural Machine Design
- 2.1.2 Design Parameters: Force, Stress, Reliability, Factor of Safety, Limit, Fit and Tolerances
- 2.1.3 Consideration of Ergonomic Parameters in Designing the Farm Machinery

2.2 Design Procedure [2 Hrs.]
- 2.2.1 Recognition and Identification of Need
- 2.2.2 Definition of Problem
- 2.2.3 Information on Functional Requirements
- 2.2.4 Prototype and Its Performance

Unit 3: Material of Construction for Agricultural Machinery, their Composition and Heat Treatment Process [3 Hrs.]

3.1 Components of Farm Machinery
- 3.1.1 General components of Farm Machinery
- 3.1.2 Critical Components of Farm Machinery
- 3.1.3 General Properties of Critical Components of Farm Machinery
- 3.1.4 Material Selection Criteria

Unit 4: Forces Acting on Tillage Implements and Hitching System [3 Hrs.]

4.1 Introduction
4.2 Forces Acting on Tillage Implement
4.3 Measurement of Soil Resistance

4.4 Design Considerations of Hitches

Unit 5: Design and Selection of Power Transmission Components in Agricultural Machines [3 Hrs.]

5.1 Introduction
5.2 V-belt, Chain, Rope, Gear, Shaft, Hydraulic Drives and Joints
5.3 Capacities of Agricultural V-belts and Chain Drives
5.4 PTO Drives
5.5 Telescopic Shaft

Unit 6: Design of Agricultural Machines [8 Hrs.]

6.1 Safety Aspects [2 Hrs.]
- 6.1.1 Introduction
- 6.1.2 Safety Factors - Concept and Application
- 6.1.3 Overload Safety Devices

6.2 Design Method of Tillage Implements [3 Hrs.]
- 6.2.1 Design of Mold Board plow
- 6.2.2 Design of Cultivator

6.3 Design Method of Crop Planter [3 Hrs.]
- 6.1.1 Design of Rice- Transplanter
- 6.1.2 Design Method of Thresher

Unit 7: Testing of Farm Machinery and power [6 Hrs.]

7.1 Objectives and Importance of Testing and Evaluation [3 Hrs.]
- 7.1.1 Role of Testing in Farm Mechanization
- 7.1.2 Concept of testing and evaluation
- 7.1.3 Terminology used testing and evaluation of agricultural machine and tractors

7.2 Instruments used in Testing and Evaluation: [3 Hrs.]
- 7.2.1 Draft
- 7.2.2 Wheel slip
- 7.2.3 Shrinkage
- 7.2.4 Soil resistance
- 7.2.5 Sound
- 7.2.6 Vibration

Unit 8: Test Codes for Agricultural Machines and Tractors [2 Hrs.]

8.1 Purpose of test codes
8.2 Types of test codes for agricultural machine
- 8.2.1 ANTAM Test Codes
- 8.2.2 RNAM Test Codes
- 8.2.3 BIS Test Codes
- 8.2.4 FAO Guidelines for Farm machinery test
- 8.2.5 Nebraska Test Codes

Unit 9: Testing and Evaluation Procedures [3 Hrs.]

9.1 Preparation for tests
9.2 Specification of implements
9.3 Test conditions
9.4 Laboratory tests
9.5 Field test

9.6 Test report format

Unit 10: Test Codes and Testing Procedures [7 Hrs.]

10.1 Primary Tillage Implements [2 Hrs.]
- 10.1.1 Test codes for Ploughs

10.2 Secondary Tillage [2 Hrs.]
- 10.2.1 Test code procedure for disc harrows

10.3 Seeding and planting implement [3 Hrs.]
- 10.3.1 Test code and procedure for row- crop cultivators
- 10.3.2 Test code and procedure for seeding equipment with or without fertilizer attachment

Unit 11: Custom Hiring Business and Its Study [3 Hrs.]

11.1 Scope of Custom Hiring Business
11.2 Economy of Custom Hiring
11.3 Climate Smart Technology in Farm Mechanization

Practical: [30 Hrs.]

1. Design Problem on Force Analysis of Tillage Tools Design Problems on Mould Board Plow
2. Design Problems on Rotary Tillage Implements
3. Design Problems on Sowing and Planting Equipment
4. Determine Visibility and noise of farm tractors
5. Determine the turning radius of general-purpose farm tractor
6. Measure the basic dimensions of tillage tools
7. Determine the field performance of seeding/ planting machines

Visit:

- Visit nearby research station of NARC to observe design and development Process of machinery and submit report [1 day]
- Visit nearby demonstration site of research station to observe different test of agricultural machineries and submit the report [1 day]

References:

1. D. N. Sharma and S. Mukesh. 2008. Farm Machinery design: Principles and Problems. Jain Brothers, New Delhi [Latest Edition].
2. H. Bernacki, J. Haman and Cz Kanafojski. 1985. Agricultural Machines: Theory and Construction. Vol. I & II. US Department of Commerce. National Technical Information Service.
3. Bainer R., Kepner, R.A. and Barger E. L. Principles of Farm Machinery. John Wiley & Sons Publications [latest edition-Indian/Low Cost Edition Preferred]
4. Smith, D.W., Sims B.G. and O'Neil D. H. 1994 Testing and evaluation of agricultural machinery and equipment: principle and practices. FAO, Rome
5. Test codes for Bureau of Indian standards, New Delhi for agricultural implements, IC engines and tractors
6. RNAM test codes and procedures for farm machinery. Regional network for agricultural machinery Bangkok/ Philippines.
7. ANTAM test codes and procedures for farm machinery, Asia and Pacific Network for Testing of Agricultural Machinery, China
8. FAO Guidelines for Testing of Agricultural Machinery

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	3	4
2	4	4
3	3	4
4	3	4
5	3	4
6	8	12
7	6	8
8	2	4
9	3	4
10	7	8
11	3	4
	45	60

* There may be minor deviation in marks distribution

Food Engineering Development
EG 3204 AE [Elective]

Year: III
Semester: II

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

Course Description:
This course aims at developing knowledge on production of various market value food products. It aims at proper packaging and canning of food products.

Course Objectives:
After completion of this subject student will be able to

1. Perform Processing and Production of various foods and packaging
2. Perform Extrusion cooking and baking
3. Market the food products
4. Make fermentation and prepare alcoholic beverage.

Course Contents

Unit 1: Food Engineering **[3 Hrs.]**

1.1 Introduction
1.2 Scope and importance of the Subject
1.3 Sensory characteristics and nutritional properties of foods
1.4 Raw material preparation [cleaning, sorting, grading and peeling]

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

2.1 Theory of Extrusion
2.2 Equipment
  2.2.1 Extrusion cookers
  2.2.2 Cold Extrusion
  2.2.3 Single Screw extruders
  2.2.4 Twin screw extruders
2.3 Application
  2.3.1 On Cereal Products [Cornflakes and Crips bread]
  2.3.2 Protein based food. [texturized Vegetable Protein]
  2.3.3 Confectionary products
2.4 Effect on foods
  2.4.1 Sensory characteristics
  2.4.2 Nutritional value

Unit 3: Baking, Roasting and Frying **[4 Hrs.]**

3.1 Theory of Baking and Roasting
3.2 Equipment
  3.2.1 Direct and indirect Heating ovens
  3.2.2 Batch ovens
  3.2.3 Continuous and semi-continuous ovens
3.3 Effect on Foods
  3.3.1 Texture
  3.3.2 Flavour, aroma and Colour
  3.3.3 Nutritional Value

3.4 Introduction to Frying of foods
3.5 Changes in Product Quality during Frying

Unit 4: Fermentation and Enzyme technology **[6 Hrs.]**

4.1 Theory of Fermentation and Enzyme technology
4.2 Food fermentation
  4.2.1 Lactic Acid fermentation
    4.2.1.1 Milk products
    4.2.1.2 Maize and Vegetables
    4.2.1.3 Meat and fish products
  4.2.2 Ethanoic Fermentation [bread and Alcoholic beverages]
  4.2.3 Mixed alcoholic –Acid Fermentations
    4.2.3.1 Vinegar and other food Acids
    4.2.3.2 Coffee and other products
4.3 Equipment for Fermentation
4.4 Effect on foods
4.5 Enzyme production from micro- organisms
4.6 Application of enzymes to food
4.7 Application of selected Enzymes
  4.7.1 carbohydrates
  4.7.2 lipases
  4.7.3 oxidases
  4.7.4 celluloses and hemicelluloses
  4.7.5 pectic enzymes

Unit 5: Production Technology **[12 Hrs.]**

5.1 Theory of production
5.2 Classification of production Systems
5.3 Equipment
5.4 Significance and advantages of production
5.5 Production management
5.6 Production monitoring and control
5.7 Production of various products
  5.7.1 Pickle
  5.7.2 jam and jelly
  5.7.3 Dry meat
  5.7.4 Juice
  5.7.5 spices
  5.7.6 milk products [cheese, paneer, butter]
  5.7.7 chips
  5.7.8 breads
  5.7.9 Tea

Unit 6: Packaging of foods **[5 Hrs.]**

6.1 Principles of food packaging
6.2 Materials used for food packaging.
6.3 Predicting the shelf life of the food
6.4 Methods of packaging
  6.4.1 Aseptic packaging
  6.4.2 Vacuum packaging
  6.4.3 Active and intelligent Packaging
  6.4.4 Modified atmosphere Packaging

Unit 7: Introduction to canning and bottling technology [3Hrs.]

Unit 8: Ultra high temperature processing [2 Hrs.]

8.1 Ultra high temperature processing of low and high viscosity foods.
8.2 Comparison of UHT with cans processing with retort
8.3 Effects on foods

Unit 9: Membrane Processing [2 Hrs.]

9.1 Introduction
9.2 Theory of Concentration
9.3 Types: Reverse osmosis, Electro dialysis, Nano filtration, microfiltration, ultrafiltration

Unit 10: Marketing and its strategies [3 Hrs.]

Practical [30 Hrs.]

1. Determine the nutritional values of food products
2. Evaluate the performance of Extrusion cookers.
3. Determine the power requirement, speed capacity of Extruders
4. Find out the sensory characteristics of food
5. Prepare of alcoholic beverages, jam, bread and butter
6. Find out the changes in product quality during frying, baking and toasting
7. Estimate the overall heat transfer coefficient and Effect of UHT in product Quality
8. Prepare an aseptic packaging for dry meats.
9. Perform Bottling of mango juice, apple juice
10. Prepare dry Potato chips in a dryer
11. Conduct a one-day field visit to tea processing plant, prepare report and present.

References

1. Verma R.C & sanjay kumar Jain, Fundamentals of Food Engineering, Himansu publication Udaypur
2. Principles of fermentation technology
3. Food Process engineering
4. FAO journals related to food developments\

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	3	4
2	5	4
3	4	4
4	6	8
5	12	16
6	5	8
7	3	4
8	2	4
9	2	4
10	3	4
	45	60

* There may be minor deviation in marks distribution

Green House Technology
EG 3204 AE [Elective]

Year: III
Semester: II

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

Course Description:
This subject is essential to equip the learners with the knowledge of Greenhouse technology, its design and maintenance, the methods of growing alternative cropping system by hydroponics and aeroponics.

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

1. Acquaint with the principles and functions of greenhouse
2. Design parameters of greenhouse
3. Construct greenhouse and install different instruments in the greenhouse
4. Apply the alternative cropping systems like hydroponic and aquaponic
5. Maintain the greenhouse

Course Contents

Unit 1: Introduction to greenhouse **[3 Hrs.]**

1.1 Definition
1.2 Historical background,
1.3 Types of greenhouse,
1.4 Functions and features of green house
1.5 Scope and development of greenhouse
1.6 Policies and practices of greenhouse in Nepal

Unit 2: Planning and construction of Greenhouse **[7 Hrs.]**

2.1 Location and components of greenhouse/poly house,
2.2 Greenhouse covering
2.3 Design criteria of greenhouse,
2.4 Methods of construction and different construction materials

Unit 3: Solar Energy in Green house **[5 Hrs.]**

3.1 Solar heat transfer in green house,
3.2 Greenhouse heating and cooling and ventilation system,
3.3 Carbon dioxide monitoring and lighting system in the greenhouse

Unit 4: Instrumentation in Green House **[5 Hrs.]**

4.1 Portable instruments to control the greenhouse environment,
4.2 Instrumentation in greenhouse:
- watering
- fertilization and
- pasteurization

Unit 5: Containers and benches in green house **[6 Hrs.]**

5.1 Floor as benches
5.2 Raised Benches
5.3 Materials for benches
5.4 Temporary/Portable Benches
5.5 Containers and type of containers

Unit 6: Plant nutrition and alternative cropping systems **[6 Hrs.]**

6.1 Basics of plant nutrition
6.2 Fertilizers and fertilization
6.3 Fertilizer calculation
6.4 Hydroponic technology:
- Substrate culture
- Water culture

6.5 Aeroponics technology

Unit 7: Plant tissue culture **[4 Hrs.]**

7.1 The basic steps involved in plant tissue culture
7.2 Tissue culture techniques
7.3 Application of plant tissue culture

Unit 8: Disease control and Integrated Pest Management [IPM] in green house: [5 Hrs.]

8.1 Integrated Pest Management: definition
8.2 Techniques used to manage pest
8.3 Greenhouse disease control:
- Cultural practices
- Treatment equipment
- Biological control

Unit 9: Economics, Operation and Maintenance **[4 Hrs.]**

9.1 Greenhouse production cost
9.2 Repair and maintenance of green house:
- Ventilation system
- Evaporative cooling system
- Heating system
- Greenhouse sanitation
- Structural repairs
- Shed clothes maintenance

Practical: **[30 Hrs.]**

1. Construct the small size/lab scale green house
2. Acquaint with Green house: Poly Film based, Glass fiber sheet based, Poly carbonate sheet based covering materials
3. Measure the humidity & air velocity inside the greenhouse
4. Measure the solar radiations inside the green house
5. Estimate the cooling requirements in a greenhouse by applying psychometric charts
6. Develop hydroponic and aeroponic systems
7. Visit a nearby functional green house, observe type and components used in green house and report it- one day

Book and References:

1. Solar Engineering Thermal Process. , By: Duffie J.A. and Beckman W.A.
2. Greenhouse Advanced Technology , By: Hanan
3. Greenhouse Operation & Management. , By: Nelson P.V.
4. Handbook of Greenhouse technology, By: Radhamanohar
5. Greenhouse Technology, By: Tiwari G.N. and Goyal

Evaluation Scheme

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

Chapter	Hrs.	Marks distribution
1	3	4
2	7	8
3	5	8
4	5	8
5	6	8
6	6	8
7	4	4
8	5	8
9	4	4
	45	60

* There may be minor deviation in marks distribution

Experts Involved

1. Om Prasad Dhakal, Campus chief, Institute of Engineering, Purbanchal Campus Dharan, Sunsari.
2. Jebed Alam, Assistant Professor, Institute of Engineering, Purbanchal Campus Dharan, Sunsari.
3. Yam Kumar Rai, Institute of Engineering, Purbanchal Campus Dharan, Sunsari.
4. Dipendra Nath Gupta, Institute of Engineering, Purbanchal Campus Dharan, Sunsari.
5. Anu shrestha, Institute of Engineering, Purbanchal Campus Dharan, Sunsari.
6. Yumun Shakya, Institute of Engineering, Purbanchal Campus Dharan, Sunsari.
7. Suman Thapa, Instructor, Institute of Engineering, Purbanchal Campus Dharan, Sunsari.
8. Raju Ghimire, Institute of Engineering, Purbanchal Campus Dharan, Sunsari.
9. Durgadhan Rai, Sr. Instructor, Institute of Engineering, Purbanchal Campus Dharan, Sunsari.
10. Samir Shakya, Instructor, Institute of Engineering, Purbanchal Campus Dharan, Sunsari.
11. Santosh Raj Tripathi, Sr. Scientist, Agriculture Research Center, Tarhara, Sunsari.
12. Narendra kumar Dangi, Assistant Professor, Institute of Engineering, Purbanchal Campus Dharan, Sunsari.