Mid-West University

Office of the Dean

Graduate School of Agriculture and Forestry

Birendranagar, Surkhet

Bachelor of Science in Agriculture (B.Sc. Ag.)

Structure of Labor Market Driven Program (LMDP) and Curriculum 2024

1. Introduction

Mid-West University (MU) was established in 2010 by the Government of Nepal as a public institution of higher education. MU is dedicated to democratizing access to quality education, particularly in under served areas, while also fostering a global learning environment. Situated in Birendranagar, Surkhet, MU's central administration and campuses serve the administrative and academic needs of the university. With a network of constituent and affiliated campuses across Karnali Province and beyond, MU is committed to providing high-quality, affordable education and technical support to various sectors, enhancing workforce and institutional capacities both locally and globally. The university is on a journey to become a "Centre of Excellence" in teaching, research, innovation, and policy advocacy.

The Graduate School of Agriculture and Forestry (GSAF) at MU is a significant initiative aimed at advancing technical education in Karnali Province and extending its benefits to national and international communities. As a hub for agricultural knowledge, GSAF aspires to drive socio-cultural transformation and economic growth through excellence in teaching, research, and extension activities.

Vision and Mission of the Graduate School

Vision

The Graduate School of Agriculture and Forestry (GSAF) envision establishing globally recognized agricultural institutions that excel in teaching, research, and extension activities. GSAF aims to be a catalyst for economic growth, innovation, and sustainable development in Nepal, promoting learning and knowledge dissemination for the nation's betterment.

Mission

The mission of GSAF is to produce globally competent and skilled agricultural graduates who can meet national and local needs. GSAF focuses on driving research activities and disseminating agricultural technology to advance the agricultural sector, fostering a new generation of youth crucial for Nepal's development and industrial progress.

2. Bachelor of Science in Agriculture (B.Sc. Ag)

The Bachelor of Science in Agriculture (B.Sc. Ag) program is designed to nurture academically proficient professionals with a strong community-oriented approach. The program spans eight semesters (four years) and integrates core, foundational, and specialized courses with a community service-based approach. This comprehensive education aims to produce skilled agricultural graduates capable of addressing local and national agricultural challenges, driving research, and disseminating agricultural technologies.

Academic Year

The academic year at GSAF operates on a semester system, consisting of two semesters per year, each lasting six months. This system ensures a structured and timely delivery of the curriculum, aligned with the Mid-West University academic calendar.

Program Goal

The primary goal of the B.Sc. Agriculture program is to educate, train, and cultivate a dynamic generation of professionals who can significantly contribute to the development and promotion of Nepal's agriculture sector. The program aims to reduce poverty through industrialization and community development, emphasizing job-oriented training and technological knowledge essential for industrial progress.

Program Objectives

Innovative Education: Develop and execute educational programs that balance traditional practices with emerging needs in agriculture.

Community Empowerment: Disseminate knowledge, skills, and technologies to empower communities for agricultural advancement and economic development.

Industry Collaboration: Cultivate skilled manpower for agriculture-based industries and strengthen institute-industry ties to address national unemployment challenges.

Resource Utilization: Explore and harness Nepal's natural resources to fuel industrial growth and development.

Ecological Balance: Advocate for and promote organic agricultural practices to maintain ecological equilibrium and ensure safe food production.

Learning Outcomes of the Program

Graduates of the B.Sc. Agriculture program at the Graduate School of Agriculture and Forestry (GSAF) emerge with a robust set of skills and competencies essential for thriving in the agricultural sector. They possess comprehensive technical competence, grounded in a deep understanding of agricultural science and proficiency in applying advanced technologies. Equipped with this knowledge, graduates are prepared to actively engage in community-based agricultural initiatives, contributing effectively to local development and addressing regional agricultural challenges. Furthermore, they demonstrate adeptness in research methodologies, capable of conducting rigorous studies, analyzing data, and innovatively solving agricultural issues. The program's emphasis on job-oriented training ensures graduates are equipped with practical industrial skills, making them competitive candidates for various roles within the agricultural industry. Advocating for sustainability

and organic farming practices, graduates play a crucial role in promoting environmental health and ensuring food safety. Additionally, they develop strong leadership qualities and collaborative abilities, enabling them to effectively lead teams and engage with diverse stakeholders across the agricultural landscape, thereby contributing to sectoral growth and innovation.

3. Course Structure and Credit Hours of the Program

The course structure of the Bachelor of Science in Agriculture (B.Sc. Ag) program at the Graduate School of Agriculture and Forestry (GSAF) is designed to provide a comprehensive foundation in agricultural sciences through a combination of Foundation and Core Courses, as well as specialized courses across various disciplines. Foundation courses encompass subjects such as Moral Education and Life Skill Development, Basic and Advanced English, Computer Fundamentals, Glorified History and Culture of Nepal, Organic Food, Health and Happiness, Disaster and Humanitarian Response, Basic Research Writing, Ethics, Publication and Seminar, and Basic Statistics and Bio informatics, totalling 15 credit hours. Specialization courses are categorized into Agriculture Economics, Agronomy, Horticulture, Soil Science, Animal Science, and Organic Agriculture, each offering focused study areas ranging from Agriculture Marketing and Policy to Precision Agriculture and One Health Management, with each specialization comprising between 5 to 6 credit hours, amounting to a grand total of 32 credit hours for specialized courses. This structured curriculum ensures students acquire both broad foundational knowledge and specialized expertise necessary for addressing contemporary agricultural challenges and opportunities.

Foundation and Core Courses

Foundation Courses				
S.N.	Sub. code	Name of the Subject	Cr. Hrs.	Total
1	CFC 410	Moral Education and Life skill development	0.5+1	1.5
2	CFC 411	Basic English	0.5+0.5	1
3	CFC 412	Computer Fundamentals	0.5 + 1	1.5
4	CFC 420	Intermediate English	0.5+1	1.5
5	CFC 421	Computer Applications	0.5+1	1.5
6	CFC 430	Advanced English	0.5+1	1.5
7	CFC 431	Glorified History and Culture of Nepal	1+0.5	1.5
8	CFC 440	Organic Food, Health and Happiness	0.5+0.5	1
9	CFC 441	Disaster and Humatarian Response	0.5+0.5	1
10	CFC 450	Basic Research Writing, Ethic, Publication and Seminar	0.5+0.5	1
11	CFC 451	Basic Statistics and Bio informatics	1+1	2
		Total Credit Hours	7+8	15

Specialization Courses

1. Agriculture Economics				
S.N.	Sub. code	Name of the Subject	Cr.hrs. (Th+Pr)	Total
1	ECO 452	Agriculture Marketing, trade and Pricing policy	1+2	3
2	ECO 460	Agriculture Development plan and Policy	1+2	3
		Total Credit Hours	2+4	6
2. Agronomy				
S.N.	Sub. code	Name of the Subject	Cred hr	Total
1	AGR 454	Agro-biodiversity and under-utilized crop species	1+2	3
2	AGR 463	Nepalese farming system and precision agriculture	1+2	3
		Total Credit Hours	2+4	6
3. Horticulture				
S.N.	Sub. code	Name of the Subject	Cred hr	Total
1	HRT 453	Indigenous horticulture crop production	1+1	2
2	HRT 472	Protected Horticulture and post-harvest technology	1+2	3
		Total Credit Hours	2+3	5
4. Soil Science				
S.N.	Sub. code	Name of the Subject	Cred hr	Total
1	SSC 455	Irrigation and water management	1+2	3
2	SSC 473	GIS and remote sensing	1+1	2
		Total Credit Hours	2+3	5
5. Animal Science				
S.N.	Sub. code	Name of the Subject	Cred hr	Total
1	ANS 456	Fodder and Pasture Management	1+2	3
2	ANS 474	Meat and Wool Product Technology	1+1	2
		Total Credit Hours	2+3	5
6. Organic Agriculture				
S.N.	Sub. code	Name of the Subject	Cred hr	Total
1	OAG 466	One Health Management	1+2	3
2	OAG 475	Organic accreditation and certification	1+1	2
		Total Credit Hours	2+3	5
		Grand Total Credit Hours	12+20	32

Elective Courses

The Bachelor of Science in Agriculture (B.Sc. Ag) program at the Graduate School of Agriculture and Forestry (GSAF) includes elective courses that complement foundational and core studies, offering student opportunities to tailor their academic journey according to their interests and career aspirations. These elective courses are designed to deepen understanding and expertise in specialized areas such as advanced agricultural technologies, sustainable farming practices, agribusiness management, soil and water conservation, crop science, livestock management, agricultural economics, and food security. Elective courses provide flexibility within the curriculum, allowing students to customize their learning experience while acquiring specialized knowledge crucial for addressing contemporary challenges in agriculture. By selecting elective courses, students enhance their skill set and readiness to contribute effectively to the agricultural sector, fostering innovation and sustainability in their future careers.

Internship and Research Project (UGRP at Bachelor Level/GRP at Graduate Level)

The Internship and Research Project components, known as UGRPs (Undergraduate Research Projects) at the bachelor level and GRPs (Graduate Research Projects) at the graduate level, are pivotal aspects of the educational experience at the Graduate School of Agriculture and Forestry (GSAF). These initiatives are designed to provide students with practical, hands-on learning opportunities that bridge theoretical knowledge with real-world application in agriculture.

At the undergraduate level, UGRPs offer students the chance to engage in supervised research under faculty mentorship, focusing on specific agricultural topics such as crop production, soil health, agricultural technology, and sustainability practices. This experience not only enhances their research skills and analytical abilities but also prepares them for future academic pursuits or careers in agriculture. Students learn to design experiments, collect and analyze data, and present their findings, thereby gaining valuable insights into the complexities of agricultural science.

For graduate students, GRPs represent an advanced phase of research where they delve deeper into specialized areas within agriculture. These projects are tailored to individual interests and academic goals, involving rigorous investigation into complex agricultural issues or innovations. Graduate students collaborate closely with faculty advisors to develop research methodologies, conduct comprehensive analyses, and contribute new knowledge to the field through publications and presentations. The GRP experience equips graduates with critical research competencies, leadership qualities, and the expertise needed to address pressing challenges in global agriculture, fostering innovation and sustainability.

4. Assessment and Examination System

Internal/Continuous Assessment

Internal assessments at GSAF/MU entail 40% of the full marks in theory for each subject, evaluated internally by the subject teacher. To qualify for the final examination, students must secure a minimum of 50% marks in the internal assessment. In instances where a student misses an assessment due to valid reasons, the course teacher may grant one opportunity for a makeup test. However, such arrangements necessitate approval from both the program coordinator and the Dean of the respective faculty. Any makeup assessments must be completed within 15 days following the conclusion of the scheduled mid-term examinations.

External/External Examination

At GSAF/MU, final examinations for theory papers and practical components will be managed through two separate systems. The MU/EMO office will oversee external examinations, which will encompass both theory and practical aspects. The final theory examination, accounting for 60% of the total marks, and the entire practical examination for each level will be conducted externally through this system. These exams will be held under external supervision to uphold standardized procedures and ensure fairness throughout the examination process.

5. Admission Requirements

Eligibility

To be eligible for admission to the Bachelor of Science in Agriculture (B.Sc. Ag) program at the Graduate School of Agriculture and Forestry (GSAF), applicants must meet the following criteria:

Academic Qualifications: Applicants must have completed one of the following:

a. Intermediate of Science (I.Sc.) in Basic Science
b. Intermediate of Science (I.Sc.) in Agriculture
c. Intermediate of Science (I.Sc.) in Veterinary Science
d. 10+2 in Science

Minimum Marks

Candidates must have secured a minimum of 50% aggregate marks from recognized universities or boards. This ensures that applicants have a strong foundational knowledge necessary for advanced studies in agriculture.

Entrance Examination

Admission to the B.Sc. Ag program is competitive and based on merit through an entrance examination. The process includes the following key aspects:

Formation of the Admission Committee: The Faculty Dean establishes an admission committee in accordance with GSAF/MU rules and regulations. This committee is responsible for developing policies regarding student intake and overseeing the entrance examination process.

Advertisement for Admission: Information regarding admission, including the entrance examination details, is advertised in national newspapers and on the official website of Mid-West University (www.mu.edu.np). This ensures wide dissemination of information to prospective students across the country.

Structure of the Entrance Examination: The entrance examination assesses the applicants' knowledge and aptitude in relevant subjects. It is designed to evaluate their readiness for the rigorous academic curriculum of the B.Sc. Ag program. The exam covers various subjects related to agriculture, physics, chemistry, biology, Mathematics and general knowledge.

Merit-Based Selection: Admission to the Bachelor of Science in Agriculture (B.Sc. Ag) program at the Graduate School of Agriculture and Forestry (GSAF) is primarily based on merit, determined by scores from the entrance examination. The top-ranking candidates are selected, ensuring that those demonstrating the highest academic potential and suitability for agricultural studies are offered admission. Additionally, GSAF upholds principles of diversity and inclusivity by reserving quotas and providing special considerations for female students, Janajati students, and individuals from disadvantaged backgrounds. These measures aim to foster a diverse student body and provide equal educational opportunities, reflecting GSAF's commitment to equity in education. By combining merit-based selection with inclusive admission policies, GSAF not only cultivates a talented student cohort but also prepares graduates to contribute effectively to the agricultural sector and society at large.

6. Course Cycle of the Program

First Semester

S.N.	Sub. Code	Name of Subjects	Cr. Hr. (Th.+ Pr.)	Total Cr. Hr.
1.	CFC 410	Moral Education and Life Skill Development	0.5 +1	1.5
2.	CFC411	Basic English	0.5 +0.5	1
3.	CFC412	Computer Fundamentals	0.5 +1	1.5
4.	ECO 413	Principles of Economics	1+1	2
5.	EXT 414	Rural Sociology	1+1	2
6.	HRT 415	Principles of Horticulture	1+2	3
7.	AGR 416	Principles of Crop Production and Weed Management	1+2	3
8.	SSC 417	Introduction to Soil Science	1+1	2
9.	ANS 418	Fundamental of Animal Science	1+2	3
10.	OAG 419	Agro-ecology and Climate Change	1+1	2
		Total	**8.5+12.5**	**21**

Second Semester

S.N.	Sub. Code	Name of Subjects	Cr. Hr. (Th.+ Pr.)	Total Cr. Hr.
1.	CFC420	Intermediate English	0.5+1	1.5
2.	CFC421	Computer Applications	0.5+1	1.5
3.	ECO 422	Farm Resource Management	1+2	3
4.	HRT 423	Plant Propagation and Nursery Management	1+1	2
5.	AGR 424	Cereal Crop Production	1+2	3
6.	SSC 425	Soil Fertility and Nutrient Management	1+2	3
7.	ANS 426	Fundamental of Animal Nutrition and Feed Management	1+2	3
8.	OAG 427	Mountain Organic Agriculture	1+1	2
9.	PPT 428	Principles of Plant Protection	1+2	3
		Total	**8+14**	**22**

Third Semester

S.N.	Sub. Code	Name of Subjects	Cr. Hr. (Th.+ Pr.)	Total Cr. Hr.
1.	CFC 430	Advanced English	0.5+1	1.5
2.	CFC 431	Glorified History and culture of Nepal	1+ 0.5	1.5
3.	ECO 432	Natural Resource Economics	1+1	2
4.	EXT 433	Agriculture Extension Methodology	1+2	3
5.	HRT 434	Fruit and Plantation Crop Production	2+1	3
6.	AGR 435	Grain Legumes, Oil Seeds and Under-utilized Crop Species Production	1+2	3
7.	SSC 436	Soil Physics and Classification	1+1	2
8.	ANS 437	Ruminant and Non-Ruminant Production	2+1	3
9.	PPT 438	Crop pests and IPM	1+2	3
10.	PLB 439	Bio-chemistry and Plant Physiology	1+1	2
		Total	**11.5+12.5**	**24**

Fourth Semester

S.N.	Sub. Code	Name of Subjects	Cr. Hr. (Th.+ Pr.)	Total Cr. Hr.
1.	CFC 440	Organic Food, Health and Happiness	0.5 + 0.5	1
2.	CFC 441	Disaster and Humanitarian Response	0.5 + 0.5	1
3.	ECO 442	Principles of Agro-enterprise Development	1+2	3
4.	HRT 443	Vegetable Production	1+1	2
5.	AGR 444	Commercial Crop Production	1+1	2
6.	ANS 445	Dairy Science and Technology	2+1	3
7.	OAG 446	Medicinal and Aromatic Plant Production	1+2	3
8.	PLB 447	Principles of Genetics	1+2	3
9.	AEN 448	Farm Structure and Survey	1+2	3
10.	AQU 449	Fundamentals of Aquaculture	1+1	2
		Total	**10+13**	**23**

Fifth Semester

S.N.	Sub. Code	Name of Subjects	Cr. Hr. (Th.+ Pr.)	Total Cr. Hr.
1.	CFC 450	Basic Research Writing, Ethics, Publication and Seminar	0.5 +0.5	1
2.	CFC 451	Basic Statistics and Bioinformatics	1+1	2
3.	ECO 452	Agriculture Marketing, Trade and Pricing Policy	1+2	3
4.	HRT 453	Ornamental Plant Production	1+2	3
5.	AGR 454	Nepalese Farming System	1+1	2
6.	SSC 455	Irrigation and Water Management	1+2	3
7.	ANS 456	Fodder Production and Pasture Management	1+2	3
8.	OAG 457	Integrated Organic Agriculture	1+2	3
9.	PLB 458	Principle and Practices of Plant Biotechnology	1+2	3
		Total	8.5+14.5	23

Sixth Semester

S.N.	Sub. Code	Name of Subjects	Cr. Hr. (Th.+ Pr.)	Total Cr. Hr.
1.	ECO 460	Agriculture Development Plan &Policy	1+2	3
2.	EXT 461	Agriculture Communication and Social Mobilization	1+2	3
3.	HRT 462	Agroforestry and Indigenous Horticultural Crop Production	1+1	2
4.	AGR 463	Seed Technology	1+2	3
5.	SSC 464	Soil Conservation and Watershed Management	1+1	2
6.	ANS 465	Animal Breeding and Biotechnology	1+1	2
7.	OAG 466	Human Nutrition and One Health Management	1+2	3
8.	PPT 467	Industrial Entomology and Mushroom Cultivation	1+2	3
9.	PLB 468	Principles and practices of Plant Breeding	2+1	3
		Total	10+14	24

Seventh Semester

S.N.	Sub. Code	Name of Subjects	Cr. Hr. (Th.+ Pr.)	Total Cr. Hr.
1.	ECO 470	Survey Research Methodology	1+1	2
2.	EXT 471	Agro Tourism Development	1+1	2
3.	HRT 472	Protected Horticulture and Post-harvest Technology	1+2	3
4.	SSC 473	GIS and Remote Sensing	1+1	2
5.	ANS 474	Meat and Wool Production Technology	1+1	2
6.	OAG 475	Organic Accreditation and Certification	1+1	2
7.	PPT 476	Crop Disease Management	1+1	2
8.	AEN 477	Farm Power and Machinery	1+1	2
9.	AQU 478	Commercial Fish Farming	1+2	3
10.	AED 479	Agriculture Entrepreneurship Development Plant Science /Animal Science /Organic Agriculture Science	0+1	1
		Total	9+13	22

Eighth Semester

1.	UPR 480 (UG Project Report)	MU Internship For Human Development Service	0+6	6
		Total	0+6	6
	Total Credit Hours		65.5 +99.5	165

7. Class Attendance

At the Graduate School of Agriculture and Forestry (GSAF), class attendance is a foundational requirement essential for academic success and engagement. The institution emphasizes the importance of regular attendance to ensure that students fully benefit from their educational experience. The attendance policy is structured with a minimum requirement of 80% attendance in each subject throughout the semester. This policy not only encourages active participation in lectures, practical sessions, and academic discussions but also fosters a disciplined approach to learning. Faculty members are responsible for maintaining accurate attendance records, which are

periodically reviewed by the Graduate School Dean or program coordinators to monitor compliance with attendance guidelines. Students who fail to meet the minimum attendance requirement may face consequences such as ineligibility to sit for final examinations in the respective subject(s), underscoring the policy's significance in maintaining academic integrity and progression.

8. Leave

The leave policy at GSAF is designed to accommodate various legitimate reasons for student absences while ensuring continuity in academic progress and fairness to all students. There are three main types of leave recognized by the institution:

1. **Medical Leave**: Granted for health-related reasons, requiring supporting medical documentation.
2. **Personal Leave**: Granted for personal emergencies or significant personal matters.
3. **Academic Leave**: Granted for academic purposes such as attending conferences, workshops, or field trips that contribute directly to the student's educational development.

Students are required to submit a formal leave application in advance, detailing the reason for their absence and the expected duration. Applications should be directed to the program coordinator or Dean and include any necessary supporting documentation to substantiate the request. The approval process involves careful consideration by the program coordinator or Dean, assessing the validity of the reason for leave and its potential impact on the student's academic progress. Approved leaves are communicated to relevant faculty members and administrative staff to ensure appropriate coordination regarding missed coursework, assignments, or assessments. Students granted leave are expected to responsibly manage their academic responsibilities by catching up on missed work in consultation with their instructors. Approved leave typically does not affect a student's attendance percentage, provided it adheres to the established leave policy guidelines and is officially approved. This structured approach to leave management enables GSAF to maintain a supportive learning environment while accommodating students' personal and academic needs effectively.

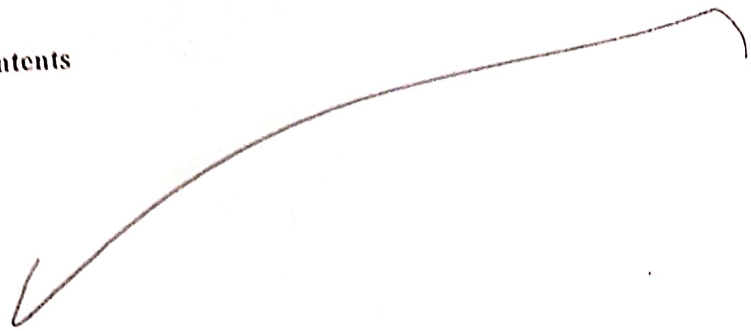
9. Grading System

S.N.	Grade	Percentage (%)	Grade Category	Grade points	Remarks
1	A	85 and above	Outstanding	4.00	
2	A-	80-84	Distinction	3.67	
3	B	75-79	Excellent	3.33	
4	B-	70-74	Very good	3.00	
5	C	65-69	Good	2.50	
6	C-	60-64	Average	2.00	
7	D	55-59	Satisfactory	1.50	
8	D-	50-54	Fair	1.00	
9	F	Less than 50	Fail	0.00	

10. Graduation Requirements

To graduate from the Bachelor of Science in Agriculture (B.Sc. Ag) program at the Graduate School of Agriculture and Forestry (GSAF), students must satisfy a comprehensive set of academic criteria and requirements. These requirements are meticulously structured to ensure graduates possess the essential knowledge, skills, and competencies necessary for successful careers in agriculture or further academic pursuits. Central to these requirements is the completion of all prescribed courses, encompassing foundational, core, specialization, and elective subjects, along with practical components that integrate theoretical learning with real-world application. Additionally, students are expected to achieve a minimum Grade Point Average (GPA) indicative of their academic proficiency. Practical experience through an internship or research project is another vital component, allowing students to apply classroom knowledge in agricultural settings. Adherence to attendance policies, successful completion of examinations, and fulfillment of all financial obligations to the university are also mandatory. Moreover, compliance with academic and institutional policies ensures ethical conduct and adherence to standards of academic integrity. These graduation requirements collectively prepare GSAF students to become competent professionals capable of contributing effectively to the agricultural sector's development and sustainability.

11. Detail Course Contents



Graduate School of Agriculture and Forestry
Birendranagar, Surkhet
Syllabus of Farm Structure and Survey

3.1 Course Syllabus

Semester IV

Course Code: AEN448

Credit Hours: 3 [Theory: 1.0; Practical: 2.0]

Course Title: Farm Structure and Survey

Teaching Hours: 48:00

Course Description: This course comprises learning of basic concepts of engineering survey of agricultural land and design parameters of farm structures including cattle, goat, sheep, poultry, swine, and storage structures. Surveying: concept, types, application in agriculture. Chain Survey: instruments, ranging, triangulation, detailing. GPS survey: introduction, use. Levelling: concept, temporary adjustments, types, use. Contour map: concept, horizontal gradient. Construction Materials: bricks, sand, aggregate, cement, mortar, concrete, RCC. Building Components: foundation, plinth level, flooring, lintel, doors, windows, flooring. Farm Structures: cow farm, poultry farm, goat and sheep, swine, cold storage, green house. Cost Estimation: types, rate analysis, bill of quantity, cost estimate, abstract of cost.

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

a. Carry out measurement of the agricultural land and prepare topographical map,
b. Calculate the area of any land and also area under map, and
c. Design and cost estimate of farm structures.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction to Farm Structures and Surveying	1.1 Introduction, Application of surveying in agriculture and farm building constructions classification of surveying, scale of map/drawing.	1:00	1.2 Group Practice: Computation of area from an existing map	2:00	Ojha T.P. & Michael A.M. (2018). Principles of Agricultural Engineering Vol.-1. 10th edition. Jain Brothers.
II	Horizontal Measurements	2.1 Instruments for chaining, tapping and ranging on flat and slope ground	0:30	2.2 Group Practice: Determination of pace factor and its use for measuring the distance	2:00	Ojha T.P. & Michael A.M. (2022). Principles of Agricultural Engineering Vol.-
		2.3 GPS surveying	0:30	2.4 Group Practice: Two-way tapping in flat and slope ground	2:00	

				2.5 Group Practice: Computation of area by measuring the land plot in the field by tapping and GPS	2:00	II. 6th edition. Jain Brothers. Punmia, B. C., Jain, A. K and Jain A. K (2016). Surveying (Volume I) -16th Edition. Laxmi Publications (P) Ltd., India.
III	Levelling Survey	3.1 Concept of leveling and Temporary adjustments of instruments	1:00	3.2 Group Practice: Ordinary leveling	2:00	
		3.3 Booking and reducing levels (height of instrument and rise fall method)	1:00	3.4 Group Practice: Determination of slope of a field plot by using level machine	2:00	
		3.5 Concept of counter lines and counter map	1:00	3.6 Group Practice: Selection of scale for a map and preparation of counter map	2:00	
IV	Construction Materials for Farm Buildings	4.1 Bricks, stones, cement, sand, gravel, concrete, mortar, steel, CGI sheet, thatch, timber, insulating materials, PCC, RCC, plastering, painting	2:00	4.2 Lab Work: Observations and testing of construction materials	2:00	Ojha T.P. & Michael A.M. (2018). Principles of Agricultural Engineering Vol.-1. 10th edition. Jain Brothers.
V	Components of Farm Buildings	5.1 Types of buildings, foundation, beam, column, wall, slab, floors, truss, roofs, door and windows, ventilations	2:00	5.2 Brain storming: Building components and their constructions	2:00	
VI	Design Criteria of Farm Structures	6.1 Dairy cattle housing	1:00	6.2 Group Practice: Design and field layout of cow farm	2:00	Bengtsson, L.P. & Whitaker, J.H. (1988). Farm Structures in Tropical Climates: A Textbook for Structural Engineering and Design. FAO.
		6.3 Poultry housing	1:00	6.4 Group Practice: Design and field layout of poultry farm	2:00	
		6.5 Goat and sheep housing	1:00	6.6 Group Practice: Design and field layout of goat and sheep farm	2:00	
		6.7 Cold storage for perishable fruits	0:30	6.8 Group Practice: Design and field layout of cold storage	2:00	
		6.9 Storage structures for grain and fodder	1:00	6.10 Group Practice: Design and field layout of storage structures for grain and fodder	2:00	Ojha T.P. & Michael A.M. (2018). Principles of Agricultural Engineering Vol.-1.
		6.11 Green house and screen house	0:30	6.12 Group Practice: Design and field layout of green house and screen house	2:00	

VII	Estimation and Costing of Farm Structures	7.1 Types of estimates (approximate and details)	0:30	7.2 Project Work: Preparation of detail cost estimate of farm structures	2:00	10th edition. Jain Brothers.
		7.3 Quantity estimate	0:30			
		7.4 Rate analysis	0:30			
		7.5 Cost estimation	0:30			
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	32:00	

3.1 Course Syllabus

Semester VII

Credit Hours: 2 [Theory: 1; Practical: 1]
Teaching Hours: 32

Course Code: AEN477
Course Title: Farm Power and Machinery

Course Description: This course provides students with an in-depth understanding of farm power and machinery, focusing on the use and management of various equipment in agricultural operations. It covers the basic concepts of farm mechanization, tillage implements, plant protection equipment, harvesting and threshing machinery, and tractors. Students will gain practical experience through field visits, workshops, and hands-on activities, which will equip them with the skills needed to operate and maintain agricultural machinery effectively. The course also addresses the challenges and trends in farm mechanization, particularly in the context of Nepalese agriculture.

Course Objectives: Upon successful completion of this course, students will be able to -

a. Identify, operate, and maintain common tillage implements and plant protection equipment
b. analyze and operate harvesting and threshing machinery, and
c. perform maintenance, repair, and safety procedures for tractors and related farm machinery.

SYLLABUS

Farm Power and Machinery: Meaning and concept of farm power and machinery, Importance, scope, and limitation of farm mechanization in Nepalese agriculture, Overview of farm mechanization history and current trends; Tillage Implements: Definition, objectives, and classification of tillage methods, Primary and secondary tillage systems and their roles in agriculture; Plant Protection Equipment: Working principles and operation of plant protection equipment, Types of sprayers (e.g., knapsack, boom, airblast, etc.), Calibration and efficiency of sprayers and dusters; Harvesting & Threshing: Types and principles of harvesting machinery, Threshing methods, including types of threshers, Combined harvester, power thresher, paddle-operated threshers and their mechanisms; Tractors & Management: Tractor types and functions, maintenance, and operation, Working principles of tractor engines and components, Tractor care and operational safety guidelines.

Unit	Macro Level Contents	Micro Level Contents				Reference
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Farm Power and Machinery	1.1 Meaning and concept of farm power and machinery	1:00	1.2 *Field Visit:* Study of farm mechanization practices in local area	1:00	Goyal, E. R., & Singh, S. (2020). Farm Power and Machinery Management. *Cost of Operation of Farm Equipment*, 67-69.
		1.3 Importance, scope and limitation of farm	1:00	1.4. *Group Discussion*: Challenges of farm	1:00	Gauchan, D., & Shrestha, S. (2017). Agricultural and rural mechanisation

		mechanization in Nepalese agriculture		mechanization in Nepal		in Nepal: status, issues and options for future. *Rural Mechanisation. A Driver in Agricultural Change and Rural Development*, 97-118. Takeshima, H., & Justice, S. E. (2020). Evolution of agricultural mechanization in Nepal. *IFPRI book chapters*, 285-325.
		1.5 Overview of farm mechanization history and current trends	1:00			
II	Tillage Implements	2.1 Definition, objectives, and classification of tillage methods	1:00			El Titi, A. (2002). *Soil tillage in agroecosystems*. CRC press. DeJong-Hughes, J., & Daigh, A. L. M. (2017). Tillage implements, purpose, and ideal use. *Upper Midwest tillage guide. Part*, 2. Raheman, H., & Sarkar, P. (2024). *Tillage Machinery-Passive, Active and Combination*. Springer.
		2.2 Primary and secondary tillage systems and their roles in agriculture	1:00	2.3 *Field work:* Identification and operation of common tillage implements (Plough, Harrow, Cultivator)	1:00	
		2.4 Selection and operation of specialized tillage implements	1:00	2.5 *Group discussion*: Study of indigenous tillage tool	1:00	
III	Plant Protection Equipment	3.1. Working principles and operation of plant protection equipment	1:00		1:00	Mohan, S. S., Ajay, A., & Kishore, A. (2021). Chapter-6 Plant Protection Equipments. *Recent Trends in*, *101*. Malik, R., Pundir, A. K., Singh, S. K., Singh, R. G., Shankar, P. R., Singh, N., & Jat, M. L. (2012). Sprayers and spraying techniques: a manual. DASH, B. S. (2016). Master of Technology In Agricultural Engineering.
		3.2 Types of sprayers (e.g., knapsack, boom, airblast, etc.)	1:00	3.3. *Field Work*: Sprayer operation and calibration in the field	1:00	
		3.4 Calibration and efficiency of sprayers and dusters	1:00	3.5. *Field Work*: Practical calibration and maintenance of sprayers and dusters	1:00	
IV	Harvesting & Threshing	4.1 Types and principles of harvesting machinery	1:00	4.2. *Field Work*: Demonstration of harvesting equipment in the field	1:00	Pandey, M. M. (2004). Present status and future requirements of farm equipment for crop production. *Central Institute of Agricultural Engineering, Bhopal*, *24*, 69-113.
		4.3 Threshing methods, including types of threshers	1:00	4.4. *Visit*: Identification and analysis of threshers (e.g., paddle-operated, power)	1:00	
		4.5 Combined harvester,	1:00	4.6. *Field Visit*: Study of	1:00	

		power thresher, paddle-operated threshers and their mechanism		combined harvesters and threshers in the field		Digambar, G. B. *DESIGN, DEVELOPMENT AND PERFORMANCE EVALUATION OF HIGH CAPACITY ENGINE OPERATED PADDY THRESHER* (Doctoral dissertation, DR. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH).
V	Tractors & Management	5.1 Tractor types and functions, maintenance and operation	1:00	5.2 *Field Work*: Tractor maintenance and engine operation in the field	2:00	Bello, R. S. (2012). Farm Tractor Systems: Operations and Maintenance. *Pub by Createspace 7290 B. Investment Drive Charl US.* Renius, K. T. (2020). *Fundamentals of tractor design* (pp. 32-35). Cham, Switzerland: Springer. Bell, B. (2010). *Farm machinery*. Old Pond Books. Butterworth, B. (2012). *Farm tractors: The case guide to tractor selection, operation, economics and servicing*. Springer Science & Business Media.
		5.3 Working principles of tractor engines and components	2:00	5.4. *Workshop Visit*: Study of tractor systems, engine maintenance, and troubleshooting	2:00	
		5.5 Tractor care and operational safety guidelines	1:00	5.6. *Workshop*: Identification of parts of farm tractors and their applications	1:00	
				5.7. *Field Work*: Practical hands-on experience with tractor controls, maintenance, and repairs	2:00	
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical**	**16:00**	

Graduate School of Agriculture and Forestry
Birendranagar, Surkhet
Syllabus of Principles of Crop Production and Weed Management

3.1 Course Syllabus

Semester I

Course Code: AGR416 *Credit Hours:* 3 (Theory: 1; Practical: 2)
Course Title: Principles of Crop Production and Weed Management *Teaching Hours:* 48
Course Description: This course constitutes of an introduction to agriculture and agronomy, weather and climate, cropping system, crop growth and yield, crop density, crop ideotypes, tillage, seed and seed quality, soil fertility management, irrigation and drainage in relation to successful crop production and weed management.

Course Objectives: This course is designed to deliver the perspectives of Crop Production and Weed Management. Specifically, this course aims to –

a. Get acquainted with and understand the basic concepts, principles, practices and management of the field and methods of crop production,
b. select different field management practices and approaches for the crop production and weed management, and
c. apply different field management practices and approaches of Karnali Province and Nepal.

Course contents

Unit	Macro Level Content	Micro Level Content				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction to Agronomy	1.1 Introduction to agriculture and agronomy, subsistence and commercial agriculture, impact of green revolution in agriculture and food production	1:00	1.2 *Class Discussion:* Agronomical classification of field crops	2:00	Acquaah, G. (2015). Principles of Crop Production: Theory, Techniques and Technology. India: Pearson Education Inc.
II	Weather and climate	2.1 Definition of weather, climate, micro-climate, Agro meteorology, elements of climate and its relationship	1:00	2.2 *Class Discussion:* Identification of various agro-meteorological tools used in weather recording	1:00	De Chandra, G. (2017). Fundamentals of

Unit	Macro Level Content	Micro Level Content				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
		with crop production.		2.3 *Class Discussion*: Classification of climatic zones and associated crops in Nepal	1:00	Agronomy. New Delhi: Oxford & IBH Publishing Co.
				2.4 *Guided discussion:* Climatic hazards and stresses and their management in -climate zones in	1:00	
III	Cropping System, Plant population and Crop Ideotypes	3.1 Definition of farming system, cropping system and pattern: mono cropping, mixed and relay cropping, inter and multiple cropping	1:00	3.2 *Group discussion:* Study of various crops and dominant cropping systems in the locality	1:00	Lenka, D. and S. Jena. (2002). Agronomy for Beginners. Kalyani Publishers. India.
		3.3 Crop planning and budgeting, scientific cropping scheme based on estimation of cropping intensity index (CII), land equivalent ratio (LER) and land utilization index (LUI)	1:00	3.4 *Guided discussion:* Growth and development of crops, sigmoid and parabolic crop growth curves, formula of crop growth analysis	1:00	
				3.5 *Guided discussion:* Calculation of cropping intensity/ cropping index land equivalent ratio and land	2:00	
		3.6 Crop density, optimum plant population, factors affecting optimum plant population, growth and development of crops.	1:00	3.7 *Brainstorm:* Concept and traits of ideotype, characteristic ideotype of rice, wheat, maize, grain legumes and oilseed crops	1:00	
		3.8 Concept and traits of ideotype, characteristic ideotype of rice, wheat, maize, grain legumes and oilseed crops, concept of growth and yield attributes	1:00	3.9 *Brainstorm* :Characteristic ideotypes of rice, wheat, maize, grain legumes and oilseed crops	1:00	

Unit	Macro Level Content	Micro Level Content				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
IV	Tillage, Seed and Sowing	4.1 Introduction to tillage, objectives of tillage, types and methods of tillage, conservation tillage	1:00	4.2 *Class discussion*: Introduction to soil erosion, their types and control methods	1:00	Reddy, S.R. (2007). Principles of Agronomy. Kalyani Publishers. Ludhiana. Third revised edition.
		4.3 Advantages and limitations of different types of tillage and scope of conservation tillage in hilly regions	1:00	4.4 *Class discussion*: Introduction, definition, objectives, types and methods of tillage, conservation tillage	1:00	
		4.5 Concept of seed science and seed technology, characteristics of seed quality and its importance, different classes of seed, seed germination and dormancy.		4.6 *Group discussion:* Advantages and limitation of different types of tillage and scope of conservation tillage in hilly regions	1:00	
				4.7 *Group discussion:* Introduction to bio-fertilizers: saprophytes, symbiotic bacteria, blue green algae, azolla, azotobacter and mycorrhiza	1:00	
V	Manures and Fertilizers	5.1 Definition and Importance of manures and fertilizers: commonly used organic manures bio-fertilizers and chemical fertilizers in agriculture	1:00	5.2 *Group discussion:* Introduction to bio-fertilizers: saprophytes, symbiotic bacteria, blue green algae, azolla, azotobacter and mycorrhiza		Sharma, K. P., K.R. Dahal and K.R. Neupane. (1991).AnIntroduction of Agronomy. IAAS, Rampur, Chitwan Publication.
				5.3 *Field Work:* Preparation of bio-fertilizers and their promotion in the community	2.00	
				5.4 *Field Work:* Factor affecting fertilizer, time and methods of fertilizer applications		

Unit	Macro Level Content	Micro Level Content				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
				5.5 *Class Discussion:* Identification of common manures and fertilizers and their nutrients composition	1:00	
				5.6 *Lab Work:* Calculation of fertilizers and manures required for various field crops and methods of fertilizer applications in agronomic crops		
VI	Irrigation and drainage	6.1 Introduction to soil-water management, irrigation and iobjectives of irrigation, importance, plant-soil-water relationship	1:00	6.2 *Field Work:* Showing different methods of irrigation and drainage used in field crops	1:00	4. Reddy, T.Y. and G.H.S. Reddy. (2016). Principles of Agronomy. India: Kalyani Publishers.
		6.3 Methods of irrigation: surface, sub-surface, sprinkler and drip irrigation practices adopted in Nepal	1:00			
		6.4 Irrigation scheduling: critical stage approach of major agronomic crops and soil moisture depletion approach in determining irrigation, Drainage: types of drainage, adverse effect of water logging	1:00			
VII	Weed	7.1 Definition, losses and benefits of weeds	1:00	7.2 *Field Work:* Identification of common weeds of major field crops	2:00	
		7.3 Classification of weeds, noxious and problematic weeds of Nepal and districts of Karnali Province	1:00	7.4 *Class discussion:* Introduction to various weed control methods and significance of integrated weed management	1:00	
				7.5 *Lab work:* Calculation of herbicides for application in major	2:00	

Unit	Macro Level Content	Micro Level Content				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
				field crops		
				7.6 *Field work:* Weed collection and preparations of her-barium sheet	1:00	
				7.7 *Group discussion:* Growth and yield attributes of major field crops	1:00	
				7.8 *Lab work:* Crop cut survey and estimation of yield of various agronomical crops	1:00	
				7.9 *Field Work:* Visit to provincial agricultural ministry, research stations and nearby farmer' s fields	1:00	
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	32:00	

Graduate School of Agriculture and Forestry
Birendranagar, Surkhet
Syllabus of Principles of Cereal Crop Production

3.1 Course Syllabus

Semester II

Course Code: AGR424
Course Title: Cereal Crop Production
Credit Hours: 3 (Theory: 1; Practical: 2)
Teaching Hours: 32

Course Description: This course comprises learning on the introduction and importance, origin, area, production, productivity, distribution, soil and climatic requirement, constraints and opportunities of production, improved cultural practices: land preparation, seeds and sowing, nutrients, water and weed management, harvesting, threshing, cleaning, drying and storage, and recommended varieties of rice, maize, wheat, barley, finger millet, buckwheat and other indigenous cereal crops grown in Karnali province and in Nepal.

Course Objectives: This course is designed to deliver the perspectives of cereal crop production. Specifically, this course aims to –

a. To acquire knowledge and perceptions in production and adaptation of cereal crop production and practices,
b. To examine the extent of instability in area, production and yield of major cereal crops in Nepal, and
c. To apply different field management practices and approaches for growing cereal crops in Karnali Province and Nepal.

Course Contents

Unit	Micro Level Contents					
	Macro Level Contents	Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	References
I	Introduction of major	1.1 Introduction, importance, origin, history, classification and domestication of major cereals	1:00	1.2 *Field Trip*: Study of various cereal crop researches conducted at research sites.	1:00	Acquaah, G. (2015).

Unit	Micro Level Contents					
	Macro Level Contents	Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	References
	issues of cereals crops grown in Nepal	1.3 Research advances in cereal crops (resource conservation technologies, bio-fortification, submergence and drought tolerance cultivars and other agronomic development) in Nepal) Production status, major problems including yield gaps and opportunities of cereal production in world and Nepal, recommended cultivars	1:00	*1.4 Field Trip:* Visit various cereal crop researches conducted at national research sites of Khajura, Banke	1:00	Principles of Crop Production: Theory, Techniques and Technology. India: Pearson Education Inc.
		1.5 Indigenous technical knowledge of cereal cultivation practices in Karnali province	1:00	*1.6 Field Trip*: Visit and study of various indigenous cereal crop researches conducted at research sites of Karnali province and in Nepal	1:00	
II	Adaptation and agronomy of rice	2.1 Adaptation: Effect of solar radiation, temperature, rainfall, wind velocity, relative humidity, altitude and latitude and soil requirements, reasons of lower yields of rice in tropical than the temperate regions	1:00	2.2 *Field Work* : Field preparation for raising rice nursery and raising rice seedlings by different ways in nurseries	2:00	De Chandra, G. (2017). Fundamentals of Agronomy. New Delhi: Oxford &IBH Publishing Co.
				2.3 *Field Work* : Common fertilizer application practices applied for various cereal crops grown during the summer seasons	1:00	
				2.4 *Group Discussion:* Study on sign of maturity of major cereal crops grown during summer seasons	1:00	
				2.5 *Field Work* : Harvesting various agronomical crops in the field and estimation of yields based on their yield attributes and net plot harvest yield of summer cereal crops	2:00	
				2.6 *Lab Work:* Estimation of major cereal crop yields based on crop cut survey and other yield forecasting tools of summer cereal	1:00	

Unit	Micro Level Contents					
	Macro Level Contents	Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	References
				crops		
				2.7 *Guided discussion:* Resource conserving technologies in cereal crops (DSR, SRI, ICM)	1:00	
		2.8 Lowland rice cultivation practices: Seed rate, seed treatment, raising rice nursery, land preparation, methods of sowing, manure and fertilizer requirements, weed and water management practices, recommended varieties, harvesting, threshing, cleaning, yield, storage	1:00	2.9 *Guided discussion:* Resource conserving technologies in cereal crops (ZTW, Precision tools: LCC, SPAD etc.)	1:00	
		2.10 History, practices and scope of rice cultivation in Jumla valley	1:00			
		2.11 Jumli Marshi and upland rice cultivation practices: Land preparation, seed rate, seed treatment, methods of sowing, manure and fertilizer requirements, weed and water management practices, recommended varieties, harvesting, threshing, cleaning, yield, storage and their value chain analysis	1:00	2.12 *Field Work:* Field preparation and sowing of maize by different land preparation and seeding methods	2:00	
III	Adaptation and agronomy of maize	3.1 Soil and climatic requirements, growth stages, seasons grown with their advantages and disadvantages	1:00	3.2 *Field Work*: Field preparation and sowing of wheat by different land preparation and seeding methods	2:00	Lenka, D. and S. Jena. (2002). Agronomy for Beginners. Kalyani Publishers. India.
		3.3 Field preparation, classification of maize and recommended varieties, seed treatment, seed rate, spacing and methods of sowing	1:00			
		3.4 Manure and fertilizer requirements and their scientific management, weed and water	1:00			

Unit	Micro Level Contents					
	Macro Level Contents	Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	References
		management practices, and critical stages of water needs for maize crop				
IV	Adaptation and agronomy of wheat	4.1 Soil and climatic requirements, growth stages, seasons grown, field preparation, recommended varieties, seed treatment, seed rate, spacing, methods of sowing with their advantages and disadvantages	1:00	4.2 *Field Work* : Common fertilizer application practices applied for various cereal crops grown during the winter seasons	1:00	Reddy, T.Y. and G.H.S. Reddy. (2016). Principles of Agronomy. India: Kalyani Publishers.
				4.3 *Lab Work:* Estimation of major cereal crop yields based on crop cut survey and other yield forecasting tools of winter cereal crops	2:00	
				4.4 *Field Work:* Physical, cultural, chemical and integrated approaches of weed management of major winter cereal crops grown	1:00	
		4.5 Manure and fertilizer requirements and their scientific management, weed and irrigation management practices, critical growth stages for irrigation, maturity judgment, harvesting, threshing, cleaning, yield and storage	1:00	4.6 *Guided discussion:* Study of growth and yield attributing characters, and crop growth analysis of major cereal crops grown during the winter seasons	2:00	
				4.7 *Group Discussion:* Study on sign of maturity of major cereal crops grown during winter seasons	1:00	
				4.8 *Field Work:* Harvesting various agronomical crops in the field and estimation of yields based on their yield attributes and net plot harvest yield of winter cereal crops	1:00	
V	Adaptation and agronomy of minor cereals	5.1 Barley: Field preparation, recommended varieties, seed treatment, seed rate, spacing, methods of sowing, manure and fertilizer requirements, weed and water management practices, harvesting, threshing, cleaning, yield and storage	1:00	5.2 *Field Work:* Field preparation, seed treatment, seed rate, methods of sowing, manure and fertilizer requirements, weed and water management practices, recommended varieties, harvesting,	1:00	Reddy, S.R. (2007). Principles of Agronomy. Kalyani Publishers.

Unit	Micro Level Contents					
	Macro Level Contents	Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	References
				threshing, cleaning, yield and storage of naked barley (uwa)		Ludhiana. Third revised edition.
				5.3 *Field Work:* Field preparation and sowing of barley by different land preparation and seeding methods	1:00	
		5.4 Finger millet: Field preparation for raising nursery, seed treatment, seed rate, methods of planting, manure and fertilizer requirements, weed and water management practices, harvesting, threshing, cleaning, yield and storage	1:00	5.5 *Field Work:* Field preparation, seed treatment, seed rate, methods of sowing, manure and fertilizer requirements, weed and water management practices, recommended varieties, harvesting, threshing, cleaning, yield and storage of finger millet in Karnali province	1:00	Sharma, K. P., K.R. Dahal and K.R. Neupane (1991). An Introduction of Agronomy. IAAS, Rampur, Chitwan Publication.
				5.6 *Field Work:* Field preparation, seed treatment, seed rate, methods of sowing, manure and fertilizer requirements, weed and water management practices, recommended varieties, harvesting, threshing, cleaning, yield and storage of Proso-millet (kaguno)	1:00	
				5.7 *Field Work:* Field preparation, seed treatment, seed rate, methods of sowing, manure and fertilizer requirements, weed and water management practices, recommended varieties, harvesting, threshing, cleaning, yield and storage of foxtail millet	2:00	
		5.8 Buckwheat: Field preparation, seed treatment, seed rate, methods of sowing, manure and fertilizer requirements, weed		5.9 *Field Work:* Field preparation and sowing of buckwheat by different land	1:00	

Unit	Micro Level Contents					
	Macro Level Contents	Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	References
		and water management practices, harvesting, threshing, cleaning, yield and storage		preparation and seeding methods		
			1:00	5.10 *Brainstorm:* Introduction to a PCN, preparation of a field layout and sowing of various field crops based on principles of field experimentation and design	1:00	
		Total hours of thematic teaching-learning	16.00	Total hours of practical activities	32:00	

3.3. Course Syllabus

Semester III

Course Code: AGR435 *Credit Hours:* 3 (Theory: 1; Practical: 2)

Course Title: Grain Legumes, Oil Seeds & Under-utilized Crop Species Production *Teaching Hours*: 48

Course Description: This course comprises learning of basic concepts of Grain legumes, oil seeds and under-utilized crop species production course and provides in-depth exploration of the different types of crops, including their history, cultivation, nutritional properties, and industrial uses.

Course Objectives: This course is designed to deliver perspective of grain legumes, oil seeds, and under-utilized crop species. Specifically, this course aims to –

a. Introduce students to the major grain legumes, oil seeds, and under-utilized crop species and their importance in agriculture and food systems,
b. learn about the production, processing, and utilization of grain legumes, oil seeds, and under-utilized crop species that are important for food security and nutrition, and
c. equip students with the knowledge and practical skills in the identification, characterization, evaluation, and utilization of these crops necessary to engage in research, development, and policymaking related to grain legumes, oil seeds, and under-utilized crop species.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction to grain legumes, oil seed crops and under-utilized crop species	1.1 Introduction and economic importance of grain legumes, oil seed crops and under-utilized crop species;Cropped area, production and productivity grain legumes, oil seed crops and under-utilized crop species; and Major challenges and opportunities, present advance research status and future innovative research strategies to uplift the grain legumes, oil seed crops and under-utilized crop species	1:00	1.2. *Group discussion:* Identification of various grain-legumes crop species grown in Nepal and local areas 1.3. *Group discussion:* Identification of various oil seed crops species grown in Nepal and local areas	2:00 2:00	Reddy, S. (2009). *Agronomy of field crops.* Ludhiana, India: Kalyani Publishers. Rehore, P. (1999). *Techniques and management of field crop production.* Jodhpur, India: Agrobios. Singh, C. (1999). *Modern Tecniques of Raising Crops.* New Delhi, India: Oxford and IBH. ISBN 81-204-0135-2 N.K. Fageria, V. C. Baligar and C.A. Jones (1990). *Growth and mineral nutrition of field crops.* New York: Marced Dekker, Inc. Agriclture Information and Training center. (2079). *Agriculture Production Statistics.* Singhdurbar, kathmandu: Ministry of Agriculture and Livestock Development G. Acquaah. (2011). *Principles of crop production-Theory, techniques and technology.* New Delhi-110001: Langston university, 2nd edition, PHI Learning Pvt. Ltd. T.Y. Reddy and G.H. S. Reddi.
II	Grain legumes crops	2.1 Lentil, chick pea, soyabean : Economic importance, origin, history and distribution, classification of crops, improved cultural practices, seed and sowing, manures and fertilizers, weed and water management, crop diseases and pests, harvesting and threshing, yield and storage	2:00	2.2 *Group discussion:* Identification of various under-utilized crop species grown in Nepal and local areas 2.3 *Field work:* Sowing and growing leguminous crop species at agronomy farm of campus	2:00 2:00	
		2.4. Lentil, chick pea, soyabean: Soil and climatic requirements, verities	1:00	2.5. *Field work:* Sowing and growing oilseed crops species at agronomy farm of campus	2:00	
		2.6. Moong bean and black gram:	2:00	2.7. *Field work:* Sowing and	2:00	

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
		Economic importance, origin, history and distribution, classification of crops, improved cultural practices, seed and sowing, manures and fertilizers, weed and water management, crop diseases and pests, harvesting and threshing, yield and storage		growing under-utilized crop species at agronomy farm of campus		(1997). *Principles of Agronomy.* SecondRevised Edition. Kalyani Publishers. Ludhiana. K.P. Sharma, K.R. Dahal and K.R. Neupane. (1991).*An Introduction to Agronomy.* Published by Institute ofAgriculture and Animal Science TNAU. (2017). *Field crop (Kharif)-ICAR ECourse PDF Book.* Tamil Nadu: https://agrimoon.com/wp-content/uploads/Field-Crop-Kharif.pdf. TNAU. (2017). *Field crop (Rabi)-ICAR ECourse PDF Book.* Tamil Nadu: https://agrimoon.com/field-crops-rabi-with-multiple-choice-questions-pdf-book/ TNAU. (2017). *Practical crop production-ICAR ECourse PDF Book.* Tamil Nadu: https://agrimoon:com/practical-crop-production-pdf-book/ Retrieved from Distribution of Underutilized Fruit in Nepal: Strategies for Conservation and Utilization. (2021) https://orcid.org/0000-0003-0041-1363 Retrieved from
		2.8. Moong bean and black gram: Soil and climatic requirements, verities	1:00	2.9. *Lab work:* Morphology and phenology of major grain-legumes crop species	2:00	
III	Oil seed crops	3.1 Rapeseed and Mustard: Economic importance, origin, history and distribution, classification of crops, improved cultural practices, seed and sowing, manures and fertilizers, weed and water management, crop diseases and pests, harvesting and threshing, yield and storage	1:00	3.2. *Lab work:* Morphology and phenology of major oil seed crop species	2:00	
		3.3. Rapeseed and Mustard: Soil and climatic requirements, verities	1:00	3.4. *Brainstorm:* Study of nodules and nodulation behaviour in legumes	2:00	
		3.5. Ground, sesame and sunflower: Economic importance, origin, history and distribution, classification of crops, improved cultural practices,	2:00	3.6. *Guided discussion:* Calculation of seed requirement for the sole and inter cropping systems with grain legumes, oil seeds crops and under-utilized crop	2:00	

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
		seed and sowing, manures and fertilizers, weed and water management, crop diseases and pests, harvesting and threshing, yield and storage		species		Neglected, under-utilized and future smart corps species in Nepal. (2019). https://doi.org/10.1080/15427528.2019.1703230
		3.7. Ground, sesame and sunflower: Soil and climatic requirements, verities	1:00	3.8. *Guided discussion:* Calculation of fertilizer requirement for the sole and inter cropping systems with grain legumes, oil seeds crops and under-utilized crop species	2:00	
IV	Under-utilized Crops	4.1 Jumli bean: Economic importance, origin, history and distribution, classification of crops, improved cultural practices, Soil and climatic requirements, verities seed and sowing, manures and fertilizers, weed and water management, crop diseases and pests, harvesting and threshing, yield and storage	1:00	4.2. *Lab work:* Growth analysis (CGR, LAI and DM) of major grain legumes, oil seed crops and under-utilized crop species	2:00 (TNAU)	
		4.3 Rice bean, adzuki bean, broad bean: Economic importance, origin, history and distribution, classification of crops, improved cultural practices, seed and sowing, manures and fertilizers, weed and water management, crop diseases and pests, harvesting	1:00	4.4. *Simulations:* Yield estimation of grain-legumes, oilseed crops and under-utilized crop species from the different yield attributes	2:00	

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
		and threshing, yield and storage				
		4.5. Rice bean, adzuki bean, broad bean: Soil and climatic requirements, verities	1:00	4.6. *Project work:* Writing proposal on major grain-legumes, oilseed crops and under-utilized crop species grown in Nepal	2:00	
		4.7. Lablab, taro, sorghum: Economic importance, origin, history and distribution, classification of crops, soil and climatic requirements, improved cultural practices, seed and sowing, manures and fertilizers, verities, weed and water management, crop diseases and pests, harvesting and threshing, yield and storage	1:00	4.8. *Field visit:* A nearby research and farm visit	2:00	
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	32:00	

3.1. Course Syllabus

Semester IV

Course Code: AGR444

Credit Hours: 2 (Theory: 1; Practical: 1)

Course Title: Commercial Crop Production

Teaching Hours: 32

Course Description: This course comprises learning on the scientific principles, modern techniques, and business aspects involved in cultivating crops on a commercial scale with aiming to equip students with the knowledge and skills required to successfully manage large-scale crop production operations, crop selection, agronomy, agricultural technology, marketing, and economic considerations.

Course Objectives: This course is designed to deliver the perspectives of commercial crop production. Specifically, this course aims to –

a. equip students with the knowledge and skills necessary to effectively grow, manage, and optimize major commercial crop production and its trends with respect to Nepalese agriculture while considering sustainable agricultural practices and environmental factors,
b. develop comprehensive crop management plans encompassing land preparation, planting techniques, irrigation, fertilization, pest and disease management, and weed control, and
c. analyze and apply sustainable agricultural practices, including crop rotation, cover cropping, and soil conservation, to enhance soil health and reduce environmental impacts.

Course contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Cotton	1.1 Economic importance, distribution and yield; ecology: relation to temperature, moisture, light and soil	1:00	1.2 *Brainstorm:* Study of classification and morphological characteristic of cotton crop.	2:00	C. Wayne Smith, J. T. (1999). *Cotton: Origin, History, Technology, and Production.* New York: John Wiley & Sons Inc. James, G. (2004). *Sugarcane (2 ed.).* Wiley-Blackwell Publishers. ISBN: 978-0-632-05476-3 Priyanka Singh, A. K.
		1.3 Cotton fiber and its quality: staple length, fineness, strength and ginning percentage	1:00	1.4 *Guided discussion:* Numerical calculation of fertilizer dose, yield estimation and seed rate of cotton	2:00	
		1.5 Seed preparation and sowing; Fertilizer management: effects of N, P and K on growth and development and dosing, timing and methods of application of	1:00			

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
		NPK fertilizers; Plant management: crust breaking, thinning, weeding, irrigation, topping, defoliation, and desiccation. Harvesting and Gossypol				(2018). *Sustainable Sugarcane Production. (1st edition).* Apple Academic Press. Jai Gopal, S. K. (2006). *Handbook of Potato Production, Improvement, and Postharvest Management. (1st edition).* CRC Press. Dean, B. B. (2019). *Managing the Potato Production System. (1t edition).* CRC Press. Arnon, I. (1972). *Crop Production in Dry Regions.* Vol. 2. Leonard Hill, London Bakumovsky Ustimenko, G. B. (1983). *Plant Growing in the Tropics and Subtropics.* Mir Publisher, Moscow Hoveland, C. S. (1980). *Crop Quality, Storage and Utilization. American Society of Agronomy, Crop Science Society of America,* Maidison, Wisconsin
II	Sugarcane	2.1 Economic importance, origin and history, distribution and yield; ecology: relation to temperature, moisture, light and soil	1:00	2.2 *Guided discussion:* Study of classification and morphological characteristics of sugarcane including noble cane and nobilization	2:00	
		2.3 Planting materials, types of planting materials, planting seed selection, seed preparation and treatment; planting methods: flat, furrow, ridge and furrow, trench, and deep trench; Fertilizer management: effects of N, P and K on growth and development and dosing, timing and methods of application of NPK fertilizers; Plant management: intercropping, earthing up, weeding, irrigation, detrashing, propping and tying and harvesting	1:00	2.4 *Lab work:* Numerical calculations in relation to seed rate, yield estimation and commercial cane sugar (CCS).	2:00	
		2.5 Ratoon management: Economic importance, distribution and yield; ecology: relation to temperature, moisture, light and soil, variety, harvest, time of harvest, method of harvest, stubble shaving, shoulder breaking. fertilizer application	1:00			

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
		and water management.				
III	Potato	3.1 Economic importance, distribution and yield; ecology: relation to temperature, moisture, light and soil;	1:00	3.2 *Guided discussion:* Study of classification and morphological characteristics of potato and potato tuber	2:00	Martin, J. H., W. H. Leonard and D. L. Stamp. (1976). *Principles of Field Crop Production. Third Edition.* Macmillan Publishing Co. Inc., New York Metcalf, D. S. and D. M. Elkins. (1980). *Crop Production: Principles and Practices. Fourth Edition.* Macmillan Publishing Co. Inc., New York Prasad, R. (2004). *Textbook of Field Crops Production.* ICAR, New Delhi Purseglove, J. W. (1974). *Tropical Crops: Monocotyledons.* The English Language Book Society and Longman, London Purseglove, J. W. (1979). *Tropical Crops: Dicotyledons.* Longman Group Limited, London Singh, C. (1997). *Modern Techniques of Raising Field Crops.* Oxford and IBH
		3.3 Seed and sowing: requirement of good seed, seed preparation, seed treatment, dormancy Planting time, seed rate, seed size and spacing, methods of planting;	1:00			
		3.4 Fertilizer management: effects of N, P and K on growth and development and dosing, timing and methods of application of NPK fertilizers; Plant management: soil loosening, earthing up, weeding, irrigation and human pulling; harvesting and storage	1:00			
IV	Jute	4.1 Economic importance, distribution and yield; ecology: relation to temperature, moisture, light and soil	1:00	4.2 *Guided discussion:* Study of classification, morphological characteristics and differences between two species of jute	2:00	
		4.3 Fertilizer management: effects of N, P and K on growth and development and dosing, timing and methods of application of NPK fertilizers; Sowing of jute, plant management: gap filling, hoeing, weeding, thinning, irrigation	1:00	4.4 *Brainstorm:* Fibres layers in jute	2:00	
		4.5 Harvesting and post-harvest operations including steeping,	1:00			

Unit	Macro Level Contents	Micro Level Contents				
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	References
		and water management.				
III	Potato	3.1 Economic importance, distribution and yield; ecology: relation to temperature, moisture, light and soil;	1:00	3.2 *Guided discussion:* Study of classification and morphological characteristics of potato and potato tuber	2:00	Martin, J. H., W. H. Leonard and D. L. Stamp. (1976). *Principles of Field Crop Production. Third Edition.* Macmillan Publishing Co. Inc., New York Metcalf, D. S. and D. M. Elkins. (1980). *Crop Production: Principles and Practices. Fourth Edition.* Macmillan Publishing Co. Inc., New York Prasad, R. (2004). *Textbook of Field Crops Production.* ICAR, New Delhi Purseglove, J. W. (1974). *Tropical Crops: Monocotyledons.* The English Language Book Society and Longman, London Purseglove, J. W. (1979). *Tropical Crops: Dicotyledons.* Longman Group Limited, London Singh, C. (1997). *Modern Techniques of Raising Field Crops.* Oxford and IBH
		3.3 Seed and sowing: requirement of good seed, seed preparation, seed treatment, dormancy Planting time, seed rate, seed size and spacing, methods of planting;	1:00			
		3.4 Fertilizer management: effects of N, P and K on growth and development and dosing, timing and methods of application of NPK fertilizers; Plant management: soil loosening, earthing up, weeding, irrigation and human pulling; harvesting and storage	1:00			
IV	Jute	4.1 Economic importance, distribution and yield; ecology: relation to temperature, moisture, light and soil	1:00	4.2 *Guided discussion:* Study of classification, morphological characteristics and differences between two species of jute	2:00	
		4.3 Fertilizer management: effects of N, P and K on growth and development and dosing, timing and methods of application of NPK fertilizers; Sowing of jute, plant management: gap filling, hoeing, weeding, thinning, irrigation	1:00	4.4 *Brainstorm:* Fibres layers in jute	2:00	
		4.5 Harvesting and post-harvest operations including steeping,	1:00			

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
		retting and extraction, jute fibre and its defects				Publishing Co.Pvt. Ltd., New Delhi Sundara, B. (1998). *Sugarcane Cultivation.1t edition.* Vikas Publishing House Pvt. Ltd. Sundaraj, D. D. and G. Thulasidas. (1993). *Botany of Field Crops. 2nd edition.* Macmillan India Limited Yadava, R. L. (1994). *Agronomy of Sugarcane: Principles and Practices. International Book.* Distributing Co., Lucknow Daren S. Starnes, J. T. (2020). *Updated Version of The Practice of Statistics. 6th edition* . W. H. Freeman.
V	Tobacco	5.1 Economic importance, difference between two species of tobacco, distribution and yield; ecology: relation to temperature, moisture, light and soil	1:00	5.2 Brainstorm: Calculations of ANOVA on CRD and RCBD	2:00	
		5.3 Classification and morphology characteristic of tobacco	1:00			
		5.4 Raising tobacco seedlings and their transplanting; Fertilizer management: effects of N, P and K on growth and development and dosing, timing and methods of application of NPK fertilizers	1:00			
		5.5 Plant management: soil loosening, weeding, irrigation, topping and de-suckering; method of harvesting, curing: definition and methods: flue curing, air curing, fire curing and sun curing	1:00			
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	16:00	

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
		retting and extraction, jute fibre and its defects				Publishing Co.Pvt. Ltd., New Delhi Sundara, B. (1998). *Sugarcane Cultivation. II edition.* Vikas Publishing House Pvt. Ltd. Sundaraj, D. D. and G. Thulasidas. (1993). *Botany of Field Crops. 2nd edition.* Macmillan India Limited Yadava, R. L. (1994). *Agronomy of Sugarcane: Principles and Practices. International Book.* Distributing Co., Lucknow Daren S. Starnes, J. T. (2020). *Updated Version of The Practice of Statistics. 6th edition* . W. H. Freeman.
V	Tobacco	5.1 Economic importance, difference between two species of tobacco, distribution and yield; ecology: relation to temperature, moisture, light and soil	1:00	5.2 Brainstorm: Calculations of ANOVA on CRD and RCBD	2:00	
		5.3 Classification and morphology cfiaracteristic of tobacco	1:00			
		5.4 Raising tobacco seedlings and their transplanting; Fertilizer management: effects of N, P and K on growth and development and dosing, timing and methods of application of NPK fertilizers	1:00			
		5.5 Plant management: soil loosening, weeding, irrigation, topping and de-suckering; method of harvesting, curing: definition and methods: flue curing, air curing, fire curing and sun curing	1:00			
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	16:00	

3.1. Course Syllabus

Semester V

Course Code: AGR454

Credit Hours: 2[Theory: 1; Practical: 1]

Course Title: Nepalese Farming System

Teaching Hours: 32

Course Description: This course comprises learning of basic concepts of farming systems, examining the interactions between crops, livestock, soil, water, and socio-economic factors with its applications and analyse the diversity of Nepalese farming systems.

Course Objectives: This course is designed to deliver perspective of grain legumes, oil seeds, and under-utilized crop species. Specifically, this course aims to –

a. enhance knowledge, skills, and attitudes to contribute to the sustainable development of Nepalese farming system, and natural resources,
b. understand the diversity of farming systems in Nepal, including the geographical, ecological, social, and cultural factors that shape them familiarizing with the main crops, livestock, and agroforestry systems in Nepal, and their contribution to environmental sustainability, and
c. analyse the factors that influence farm management decisions and apply principles of sustainability to evaluate and improve farm practices.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Nepalese Farming System	1.1. System and System approach in agriculture	1:00	1.2. *Micro presentations:* Determinants of Farming Systems: Biotic and Abiotic factors, Climatic Factors and Edaphic Factors	2:00	FAO. (1989). Farming system development: concepts, methods and applications, FAO, Rome. Farming systems and sustainable agriculture. http://jnkvv.org/PDF/05042020134251 34200822.pdf Rana, S.S. (ed.). (2011). Farming systems and sustainable agriculture department of agronomy. CSKHPKV, Palampur. Cropping systems Theory and Practice
		1.3. Farming Systems: concept and Definition , Importance, problems and its impact on agriculture	1:00	1.4. *Micro presentations:* Determinants of Farming Systems: Biotic and Socioeconomic (economic, social and policy) factors	2:00	
		1.5. Farming System Types and System and factors affecting Types of Nepalese Farming System	1:00			

		1.6. Farming system components and their maintenance	1:00			-Chatterjee B.N. and Maiti S. Cropping Systems in Tropics – Principles and practices. -Palanniappan S.P.
		1.7. Source of Livelihood and Economic Security	1:00			
II	Cropping and Farming System	2.1 Cropping system and pattern, multiple cropping system	2:00	2.2 *Project Work:* Preparation of cropping scheme under different Agro-climatic conditions of Nepalese Farming System	2:00	Doulas, G.K. (1984). Agricultural sustainability in a changing world order. West view press, Boulder, Colorado.
		2.3. Efficient cropping system and their evaluation	1:00	2.4. *Project Work:* Prepare important rotations for Mountains, Hills, and Tereai region of Nepal	2:00	
		2.5. Allied enterprises and their importance	1:00			
III	Nepalese Farming Systems in Perspective	3.1. Nepalese Farming Systems: Past, Present and Future	1:00			Chitrakar, P.L. (1990). Planning, agriculture and farmers: strategies for Nepal. Publisher: Mrs. Ganesh Devi Chitrakar, Kathmandu, Nepal
		3.2. Nepalese Farming Systems at the Cross Roads	1:00			
IV	Resource Base of Nepalese Farming Systems and their Integration	4.1. Land Resources: Status, Prospects and Management	1:00	4.2. *Field Trip:* Preparation of different models of farming systems.	4:00	Chitrakar, P.L. (1990). Planning, agriculture and farmers: strategies for Nepal. Publisher: Mrs. Ganesh Devi Chitrakar, Kathmandu, Nepal. FAO. (1989). Farming system development: concepts, methods and applications, FAO, Rome
		4.3. Plant Resources: Status, Prospects and Management	1:00			
		4.4. Animal Resources: Status, Prospects and Management	1:00			
V	Farming System Research	5.1. Concepts and design	1:00	5.2. *Group Discussion:* Tools for determining production and efficiencies in cropping and farming system	4:00	Neupane, F.P. and R.C. Sharma. (1994). Farming systems research and extension in Nepal. Institute of Agriculture and Animal Science, TU, Kathmandu, Nepal
		5.3. Evolution and methodology	1:00			
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	16:00	

3.1. Course Syllabus

Semester VI

Course Code: AGR463 *Credit Hours:* 3[Theory: 1; Practical: 2]

Course Title: Seed Technology *Teaching Hours*: 42

Course Description: This course focuses on the science, technology, and management of seeds with a comprehensive understanding of the principles and practices involved in seed production, processing, storage, and quality control.

Course Objectives: This course is designed to deliver perspectives of seed technology. Specifically, this course aims to –

a. Prepare students for careers in seed production, seed research and management, seed quality control and seed industry management that contribute to the sustainable development of agriculture through the production of high-quality seeds,
b. provide students with a thorough knowledge of seed biology, physiology, genetics and their implications for seed production, and also familiarize with the different types of seeds, including hybrid, genetically modified, and organic seeds, and their advantages and disadvantages, and
c. equip students with practical skills and techniques for seed production, including seed collection, processing, testing, storage, and distribution

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction of seed and seed technology	1.1 Definition of fruits, seed, seed grains, seed materials; importance and scope of seed technology and history of seed production	1:00	1.2. Field Work and Discussion: Identification of seeds of various field crops grown in Nepal and local areas	2:00	Agriclture Information and Training center. (2079). Agriculture Production Statistics. Singhdurbar, kathmandu: Ministry of Agriculture and Livestock Development. Bhattachan, B. (2011). Research manual of seed technology. Bhattachan, B. (2010). Manual of principles and
		1.3. Seed system in Nepal; National seed vision (2013-2025) of Nepal, National Seed Law, International Seed Testing Association	1:00			
		1.4. Classes of seeds (breeder, foundation, certified, improved, truthful labeled; composite and hybrid seeds); chemical composition; quality seed Characteristics	1:00			

Unit	Macro Level Contents	Micro Level Contents: Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	References
II	Seed formation and development	2.1 Seed formation and development, factor affecting seed growth and development	1:00	2.2. *Field Trip:* Visit nearby seed production farms of cereal crops	2:00	practices of seed technology. Agrawal, R. (2005). *Seed technology.* New Delhi: Oxford and IPH publishing Co. Pvt. Ltd. Reddy, S. (2008). *Principles of crop production.* New Delhi: Kalyani Publishers. L.O. Copeland and M.B. Mcdonald. (1985). *Principles of seed science and technology.* Minnesota, USA: Burgress Publishing Company. Justice OL and NB Louis. (1978). *Principles and practices of seed storage.* Agric. hand Book No 506. (G., 2011) TNAU. (2017). *Principles of seed technology -ICAR ECourse PDF Book.* Tamil Nadu: https://agrimoon.com/principles-of-seed-technology-pdf-book/ Retrieved from
		2.3. Seed germination: types, process and factors affecting seed germination; Seed dormancy: causes, types and methods of breaking seed dormancy	1:00	2.4. *Field Trip:* Visit nearby seed production farms of oilseed crops	2:00	
		2.5. Definition of seed vigour, seed viability and seed moisture test: principles and methods of vigour, viability and moisture test.	1:00	2.6. *Field Trip:* Visit nearby seed production farms of pulse crops	2:00	
III	Seed Production technology	3.1 General principles and agronomic management in seed production, Genetic and agronomic principles of quality seed production	1:00	3.2 *Field Trip:* Visit to seed testing laboratories	2:00	
		3.3 General technique of seed production in important agricultural crops. (i) Cereals: Wheat, rice, barley, maize, sorghum and bajra. (ii) Pulses: Chickpea, pigeon pea, field pea, and lentil (iii) Oil Seeds: Rape seed, mustard, groundnut, sesamum, and soyabean. (iv) Commercial crops - sugarcane and jute	4:00	3.4 *Field Trip:* Visit nearby seed processing plant	2:00	
IV	Seed Processing and marketing	4.1 Seed crop harvesting, drying, threshing and cleaning, seed processing, storage and marketing, measures for pest and disease	1:00	4.2. *Group Discussion*: Seed certification : Procedure	4:00	

Unit	Macro Level Contents	Micro Level Contents				
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	References
		control during storage				https://coabnau.in/uploads/1614918187_Content-Prac.COAGPB-4.4Final-converted.pdf Retrieved from Seed act (2045). https://lawcommission.gov.np/en/?p=19072 Training Manual on Tharamana Vidhai Urpathi Muraigal (Quality Seed Production Methods), (2009). Joint Director of Agriculture, Kancheepuram. pp. 20. Srimathi, P., et al., (2008). *Approaches for Commercial Seed Production. Department of Seed Science and Technology*. Centre for Plant Breeding and Genetics, Tamil Nadu Agricultural University, Coimbatore. pp. 150.
		4.3 Seed certification: objectives, concepts, general principles, field inspection procedures, agencies involved in seed certification in Nepal, and minimum seed certification standards	1:00	4.4 *Preparation:* Field Seed Field inspection, preparation of seed field inspection report	2:00	
V	Variety release and registration process	5.1 Variety release and registration process, released varieties, variety development and maintenance breeding, seed multiplication process, and barriers of seed sector development in Nepal	2:00	5.2. *Field Work and Presentation:* Seed blending practices commonly practiced in Nepal and world	2:00	
VI	Seed testing and seed rate calculation	6.1 Seed testing- importance, procedures, purity, viability and germination and seed rate calculation	1:00	6.2. *Lab Work:* Physical purity test 6.3. *Lab Work:* Seed moisture test 6.4. *Lab Work:* Practices on seed germination test in lab and field 6.5. *Lab Work* :Seed viability test 6.6. *Lab Work:* Seed and seedling vigor test 6.7. *Lab Work:* Estimation of seed amounts for various agronomic crops	2:00 2:00 2:00 2:00 2:00 2:00	
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	32:00	

Graduate School of Agriculture and Forestry
Birendranagar, Surkhet
Syllabus of Fundamental of Animal Science

3.1 Course Syllabus

Semester I

Course Code: ANS418
Course Title: Fundamental of Animal Science

Credit Hours: 3 [Theory: 1; Practical: 2]
Teaching Hours: 48

Course Description: This course provided foundational knowledge of animal science and introduced students to essential daily farm practices. It aimed to prepare students to understand the basic principles and practical applications in animal farming.

Course Objectives: The general objective of this course is to provide students with foundational knowledge of animal science. Specifically, the course aims to –

a. To understand the basic knowledge of animal science to operate the animal farm
b. To learn the processes of rearing animal and to teach the methodology of conservation technique
c. To develop practical knowledge of operating daily farm practices

SYLLABUS

Unit	Macro Level Contents	Micro Level Contents			Lecture Hours	Reference
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning		
I	Livestock and Poultry Overview	1.1. Introduction: scientific classification and terminologies used in livestock and poultry production	1:00	1.2. *Lab work* : Common equipment used in livestock production	2:00	Robinson, T. P., Thornton, P. K., Franceschini, G., Kruska, R. L., Chiozza, F., Notenbaert, A. & See, L. (2011). *Global livestock production systems*. FAO and ILRI. Wilson, R. T. (1997). Animal genetic resources and domestic animal diversity in Nepal. *Biodiversity & Conservation*, *6*, 233-251. Varijakshapanicker, P. (2022). The Livestock System in Nepal–An Overview. Harfoot, C. G. (1981). Anatomy, physiology and microbiology of the ruminant digestive tract. *Lipid metabolism in ruminant animals*, 1-19. Wiseman, J. (Ed.). (2013). *Feeding of non-ruminant livestock*. Elsevier.
		1.3. Current statistics, scope and importance of Livestock and poultry in Nepal	1:00	1.4. *Farm work :* Tagging, branding, ear notching, etc. and method of handling and restraining (Equipment used)	3:00	
		1.5. Differences between ruminants and non-ruminants: Morphological, Anatomical, Physiological and general differences of	2:00			

		Ruminants and Non-Ruminants				
		1.6. Animal genetic resources of Nepal: Breeds of cattle, buffalo, sheep, goat, pig, poultry, and conservation techniques	2:00	1.7. *Farm work :* Identification of exotic and indigenous breeds of livestock and poultry	2:00	
II	Animal Care and Management	2.1 Care and management: Newborn, pregnant (pre and post-parturition), lactating, breeding bull, and poultry management	2:00			Ghosh, N. (2019). *Livestock production management*. PHI Learning Pvt. Ltd. Purohit, H., & Parkash, J. CHAPTER-11 Care and Management of Bullocks and Breeding Bull. Wiese, W. H. (2004). Veterinary guides for livestock and poultry owners. *Journal of agricultural & food information*, *6*(2-3), 65-91. Martins, P. G., & Laugeni, F. P. (2005). Production management. *São Paulo: Saraiva.*
		2.2. Record keeping, Weaning, Dusting, Grooming, Dipping, Castration, Dehorning, Disbudding, Milking practices, Vaccination, Debeaking, Culling, Needle teeth cutting, Cleaning, Feeding, Waste management etc.	2:00	2.3. *Farm work :* Farm recording, Dusting, Grooming, Dipping, Vaccination, Debeaking, Culling, Needle teeth cutting, Weighing, Ageing etc.	4:00	
				2.4. *Farm work :* Dehorning and disbudding of different farm animal	3:00	
				2.5. *Farm work :* Practice of castration for small animal	1:00	
				2.6. *Farm work :* Practice of castration for large animal	2:00	
		2.7. Housing and management: Types of housing for livestock and poultry birds	1:00	2.8. *Farm visit* : Visit to different Livestock and poultry farm	2:00	
III	Animal Health and Bio-Security	3.1. Animal health: Signs and symptoms of health and disease conditions and management in livestock and poultry	1:00	3.2. *Field visit* : Visit to veterinary hospitals/clinics to observe animal health and disease conditions	3:00	Sans, E. C. O., Tuyttens, F. A. M., Taconeli, C. A., Rueda, P. M., Ciocca, J. R., & Molento, C. F. M. (2021). Welfare of broiler chickens reared under two different types of housing. *Animal Welfare*, *30*(3), 341-353. Ingvartsen, K. L., & Andersen, H. R. (1993). Space allowance and type of housing for growing cattle: A review of performance and possible relation to
		3.3. Bio-Security management: Importance of bio-security, sanitation, and hygiene in livestock production systems	1:00	3.4. *Group work* : Shearing of wool and grading practices of different types of wool in Karnali Province	2:00	

		3.5 Signs and symptoms of health and disease condition and management in Livestock and poultry	1:00	3.6. *Lab work* : Identification of different internal organs of livestock and poultry	2:00	neuroendocrine function. *Acta Agriculturae Scandinavica A-Animal Sciences*, *43*(2), 65-80. Sharma, M., & Gupta, A. (2024). Housing of Sheep and Goat Under Different Management Systems. *Bio Vet Innovator Magazine*, *1*, 42-49. Singleton, V. (2010). Good farming: Control or care. *Care in practice: On tinkering in clinics, homes and farms*, 235-256.
				3.7. *Group work* : Milking practices and farm visit for hands-on exposure to different farm operations	2:00	
IV	Animal selection and Draft use	4.1. Different criteria of Judging and selection for livestock and poultry marketing and breeding	1:00	4.2. *Farm work* : Judging and selecting animals for different purposes	2:00	Nielsen, H. M., Amer, P. R., & Byrne, T. J. (2014). Approaches to formulating practical breeding objectives for animal production systems. *Acta Agriculturae Scandinavica, Section A—Animal Science*, *64*(1), 2-12. Singh, A. (2014). Common cattle diseases: Symptoms, treatment and prevention. *Dairy Year Book*, 446-453.
		4.3. Use of draft animal and its role in transhumance system	1:00	4.4. *Group work* : Practical experience with draft animals	2:00	
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**32:00**	

Graduate School of Agriculture and Forestry
Birendranagar, Surkhet
Syllabus of Fundamental of Animal Science

3.1 Course Syllabus

Semester II

Course Code: ANS426
Course Title: Fundamental of Animal Nutrition and Feed Management

Credit Hours: 3 [Theory: 1; Practical: 2]
Teaching Hours:

Course Description: This course provides foundational knowledge of animal nutrition, emphasizing feed management practices that improve livestock health and productivity.

Course Objectives: The general objective of this course is to provide students with fundamental knowledge of animal nutrition. Specifically, the course aims to

a. To understand the different quality of feed stuff and to know the proximate analysis of the feed,
b. To learn the basic properties of the major nutrient available for feeding animal as feed, and,
c. To develop the practical knowledge of formulating feed for different farm animal.

SYLLABUS

Unit	Macro Level Contents	Micro Level Contents				Reference
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction of Animal Nutrition	1.1. The definition and scope of animal nutrition, the role of nutrition in livestock productivity and health.	1:00			Khanal, P., Dhakal, R., Khanal, T., Pandey, D., Devkota, N. R., & Nielsen, M. O. (2022). Sustainable livestock production in Nepal: A focus on animal nutrition strategies. Agriculture, 12(5), 679. Singh, S. B., & Singh, N. (2019). Nepal livestock feed balance and strategies to address the feed deficit. Journal of
		1.2. Overview of basic nutritional principles: digestion, absorption, and metabolism.	1:00			
		1.3. Basic Concepts of Feed Efficiency	1:00			

						Agriculture and Forestry University, 3, 159-171.
II	Feedstuffs for Livestock and Poultry	2.1. Role and Classifying feedstuffs according to their nutrient content	1:00			Pekel, A. Y., Kizil, A., Calik, A., Kuter, E., Ahsan, U., Alatas, M. S., & Kahraman, O. (2022). Classification of commonly used feed ingredients based on flow properties. *International Agrophysics*, *36*(2). Parimelazhagan, T., & Thangaraj, P. (2016). Proximate composition analysis. *Pharmacological assays of plant-based natural products*, 21-31.
		2.2. Proximate analysis of feeds and common fodder (DM, Moisture, Ash, CP, EE, CF)	1:00	2.3. *Lab work:* Preparation of standard solution for proximate analysis	2:00	
				2.4. *Lab work* : Proximate analysis of feeds and common fodder(DM, Moisture, Ash, CP, EE and CF)	3:00	
		2.5. Energy Feedstuffs, Protein Feedstuffs, Mineral and Vitamin Feedstuffs	1:00	2.6. *Filed work* : Preparation of local raw material for feed management	2:00	
III	Feed management			3.1. *Farm visit* : Visit to different feed industry	2:00	Singh, S. B., & Singh, N. (2019). Nepal livestock feed balance and strategies to address the feed deficit. *Journal of Agriculture and Forestry University*, *3*, 159-171. Benham, C. L., & Redman, P. L. (1980). Preservation of moist hay-a review. Murdoch, J. C. (1961). A review of silage-making techniques. *Grass and Forage Science*, *16*(4), 253-259. Omoniyi, L. A., Isah, O. A., Adewumi, O. O. O., Arigbede, O. M., & Onwuka, C. F. I. (2013). P hys ic o-Chemical Properties and Storability of Urea Molasses Multi Nutrient Feed Block (UMMB) as Dry Season Supplement for Ruminants. *Journal of Applied Agricultural Research*, *5*(1), 113-121.
		3.2. Present status, practices, and major sources of commonly used foodstuffs in Nepal	1:00	3.3. *Farm visit* : Survey of modern and traditional livestock and poultry farms for the feed and feeding management	2:00	
		3.4. Techniques for Hay and silage making and its importance in animal feed. Role of non-conventional feedstuffs in animal diets.	1:00	3.5. *Filed work* : Preparation of Hay and its storage	2:00	
				3.6. *Filed work* : Silage preparation	2:00	
				3.7. *Lab work* : UMMB/UMB (Urea Molasses Mineral Blocks)	2:00	
				3.8. *Group discussion*: Non-Conventional feed stuffs	2:00	
				3.9. *Filed work* : Preparation of Hydroponics	1:00	
IV	Major nutrients	4.1. Water-Function, requirement and management	1:00			Azizah, S., Aprylasari, D., Djunaidi, I. H., Rachmawati, A., & Indrati, R. (2024). EMPOWERING POULTRY FARMERS THROUGH TRAINING ON PREPARING
		4.2. Carbohydrate- Classification, functions, deficiency systems, major sources, digestion and metabolism	1:00			

		4.3. Protein- Classification, functions, deficiency systems, major sources, digestion and metabolism	1:00			FEED RATIONS BASED ON LOCAL RAW MATERIALS IN MOJOKERTO REGENCY. *Jurnal Pengabdian Kolaborasi dan Inovasi IPTEKS*, *2*(4), 1264-1273. Devendra, C. (1985). Non-conventional feed resources in Asia and the Pacific.
		4.4. Lipid-Classification, functions, deficiency systems, major sources, digestion and metabolism	1:00			
		4.5. Minerals- Classification, functions, deficiency systems and major sources	1:00	4.6. *Field visit* : Overview of essential minerals, their functions, and signs of deficiencies.	1:00	
		4.7. Vitamins- Classification, functions, deficiency systems and major sources	1:00	4.8. *Group discussion*: Overview of essential vitamins and their roles in animal health and nutrition.	1:00	
V	Feed Formulation and Feeding Standards	5.1. Brief of feed formulation and feeding standards of livestock and poultry	1:00	5.2. *Class work*: Computation of feeds for cattle and buffalo	2:00	Kuntal, R. S., Gupta, R., Rajendran, D., & Patil, V. (2022). *Livestock Ration Formulation for Dairy Cattle and Buffalo.* CRC Press. De Lange, C. F. M., & Birkett, H. (2005). Characterization of useful energy content in swine and poultry feed ingredients. *Canadian Journal of Animal Science*, *85*(3), 269-280. Alhotan, R. A. (2016). *Strategies to improve poultry feed formulation for maximum performance and profitability* (Doctoral dissertation, University of Georgia).
		5.3. Principles of feed formulation and feeding standards, Computation of feeds for different animals	1:00	5.4. *Class work* : Computation of feeds for sheep and goats	2:00	
				5.5. *Group work*: Formulating feed for swine based on nutritional needs.	2:00	
				5.6. *Lab work*: Feed formulation for poultry, considering their unique dietary needs.	2:00	
				5.7. *Group work*: Calculating appropriate feed for horses based on their activity and physiology.	1:00	
				5.8. *Group work*: Sampling of feed ingredients for chemical analysis	1:00	
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	32:00	

Graduate School of Agriculture and Forestry
Birendranagar, Surkhet
Syllabus of Fundamental of Animal Science

3.1 Course Syllabus

Semester III

Course Code: ANS437
Course Title: Ruminant and Non-Ruminant Production

Credit Hours: 3 [Theory: 2; Practical: 1]
Teaching Hours:

Course Description: This course provided advanced knowledge about ruminant and non-ruminant animals. It covered theoretical aspects as well as practical rearing techniques, focusing on breed identification, housing systems, common diseases, and animal handling.

Course Objectives: The general objective of this course is to provide advance knowledge of different animal like ruminant and non-ruminant. Specifically, the course aims to –

a. Understand the basic principle of differentiating ruminant and non-ruminant,
b. learn the basic process of diagnosis of disease and interpretation of disease, and
c. develop practical skills of rearing technique of ruminant and non-ruminant.

SYLLABUS

Unit	Macro Level Contents	Micro Level Contents				Reference
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Practical Hours	
I	Introduction	1.1 Introduction, scope and statistics of ruminant and non-ruminants and poultry in Nepal	1:00			Banerjee, G. C. (2018). *A textbook of animal husbandry* (8th ed.). Oxford & IBH Publishing Co. Pvt. Ltd.
		1.2 Zoological classification of different farm animal(Buffalo, Cattle, sheep, goat, pig, horse and rabbit) and poultry(Poultry, ostrich, quail and	5:00			

		pheasant)				Jain, P. C. (2019). *Livestock production and management.* Agrotech Publishing Academy.
II	Prominent Breeds and Characteristics	2.1 Buffalo		2.2. *Field visit* : Field visit for the identification of indigenous and exotic breed of	2:00	Sastry, N. S. R., Thomas, C. K., & Singh, R. A. (2016). Livestock production management (8th ed.). Kalyani Publishers. Ranjhan, S. K. (2007). Animal nutrition and feeding practices. Vikas Publishing House.
		2.3. Indigenous breeds (Lime, Parkote, Gaddi)		2.4. *Field visit:* Identification of Breed (Buffalo, cattle, sheep, Goat, Pig, Horse and Poultry)	1:00	
		Exotic Breed (Murrha, Surti, Jaffarbadi, Nili Ravi)				
		2.5. Cattle				
		Indigenous breeds (Siri, Lulu, Pahadi, Yak/Nak, Khaila, Terai)				
		Exotic Breeds (Jersy, Holstein friesian, Brown swiss, Hariana, Sahiwal, Red sindhi and Ayrshire)				
		2.6. Sheep				
		Indigenous (Bhyanglung, Baruwal, Lampuchhre and Kage)				
		Exotic (Merino, Rambouillet, Polwarth, Leicester and Lincoln)				
		2.7. Goat				
		Indigenous (Terai goat, Khari, Sinhal, Chyangra)				
		Exotic (Saenen, Toggnberg, Jamunapari, Barberi, Beetal, Black Bengal and Boer)				
		2.8. Pig				
		Indigenous (Hurra, Bampudke, Chwanche and Pakhribas black)				
		Exotic (Landrace, Duroc, Tameworth, Hamsphire and Yokshire)				
		2.9 Poultry				
		Indigenous (Pwankh ulte, Sakini, Ghati Khuile)				
		Exotic (New Hampshire, Rhode Island Red, Sussex, Plymouth Rock and Leghorn)				
		2.10 Horse				

		Indigenous (Jumli, Chyanta, Tanghan, Terai, Tattu, Bhotia, Marwari and Manipuri)				
		Exotic (American Paint Horse, American Saddlebred, Appaloosa, Arabian, Morgan, Palomino and Pinto)				
III	Care And Management Of farm animals	3.1 Cattle, Buffalo, Sheep, Goat, Pig and Horse (Pregnant and lactating)	3:00	3.2. *Field visit* : Visit for the observation of different stages cattle, buffalo, sheep, goat, pig and horse	2:00	Hafez, E. S. E., & Hafez, B. (2000). Reproduction in farm animals (7th ed.). Lippincott Williams & Wilkins. McGlone, J. J., Pond, W. G., & Schoknecht, P. A. (2012). Animal welfare and behavior. Cengage Learning.
		3.3 Cattle, Buffalo, Sheep, Goat, Pig and Horse (Breeding Bull)	2:00			
		3.4 Draft animal	1:00			
		3.5 Poultry (Different stage as Brooding stage, Starter, Grower, Layer and Finisher)	2:00	3.6 *Field visit* : Visit for the observation of different stages of poultry	1:00	
IV	Construction And Management Of Housing System	4.1 Housing principle of ruminants (Cattle, Buffalo, Sheep and Goat)	2:00	4.2 *Field visit*: Study livestock and poultry housing at different farms	1:00	Singh, A. K., & Ranjan, R. (2014). *Livestock housing and environment*. Satish Serial Publishing House. Ensminger, M. E. (2002). *Animal science* (9th ed.). Pearson Education.
		4.3. Housing principle of non-ruminants (Pig, Horse)	2:00			
		4.4 Housing principle of poultry	1:00			
V	System in ruminant and Non-ruminant	5.1 Digestive system of ruminants, non-ruminants and poultry	2:00	5.2 *Lab work:* Study of Digestive and Reproductive system of different livestock and poultry	2:00	Dyce, K. M., Sack, W. O., & Wensing, C. J. G. (2017). *Textbook of veterinary anatomy* (5th ed.). Elsevier Health Sciences.
		5.3. Reproductive system and mechanism of secretion and letdown of milk	3:00			

		5.4. Common animal diseases and their prevention and control	1:00	5.5. *Lab work*: Diagnosis of common disease in animals- sample collection, transportation, Dispatch, Examination, Result interpretation and Diagnostic approach	1:00	Radostits, O. M., Gay, C. C., Hinchcliff, K. W., & Constable, P. D. (2007). *Veterinary medicine: A textbook of the diseases of cattle, horses, sheep, pigs, and goats* (10th ed.). Saunders Elsevier.
		5.6. Systemic disease, Metabolic disease, Bacterial disease, Viral disease and Parasite: Internal and External)	2:00			
VI	Restraining and handling of farm animals	6.1. Restraining and handling- Anti cow kicker, Bull nose ring, Bull nose ring, Bull leader or bull pole, Bull holder, Drink waters gags, wooden gag, halter, Mzzle, Travis or cruch or stocks, using wooden cradles, Casting	2:00	6.2. *Group work* : Restraining and handling of farm animal	1:00	Grandin, T. (2015). *Improving animal welfare: A practical approach* (2nd ed.). CABI Publishing. Ewbank, R. (2003). *Handling and restraint of animals*. In Cooper, J. E. (Ed.), *Veterinary forensics: Animal cruelty investigations*. CRC Press.
				6.3. *Group work*: Casting and general handling of farm animal	1:00	
VII	Routine farm practices	7.1. Dehorning, Debeaking, Milking Practices	2:00	7.2. *Farm Work*: Dehorning of farm animal	1:00	Thomas, C. K. (2010). Livestock routines and farm practices. Kalyani Publishers. Ensminger, M. E., & Parker, R. O. (2003). Swine science (7th ed.). Pearson Prentice Hall.
				7.3. *Group work:* Debeaking of poultry	1:00	
				7.4. *Group work*: Milking Practices	1:00	
				7.5. *Group work:* Cleaning of milking parlor	1:00	
Total hours of thematic teaching-learning			**32:00**	**Total hours of practical activities**	**16:00**	

3.1. Course Syllabus

Semester IV

Course Code: ANS 445 *Credit Hours:* 3 [Theory: 2; Practical: 1]

Course Title: Dairy Science and Technology *Teaching Hours*: 48

Course Description: Dairying in Nepal and abroad. Diagrammatic representation of milk constituents its composition, nutritive value and properties of milk. Factors affecting the composition. Hand milking and machine milking methods. Flavour defects, types of microorganisms found in milk, and its significance in dairy industry. Probiotic bacteria and their importance in human health. Raw milk processing procedures, different platform and routine tests. Milk pasteurization and sterilization, their importance and methods. Process of toning and standardization of market milk. Cleaning, sanitation and maintenance of dairy equipment, Project planning for mini dairy plant in brief and payment system of milk in Nepal. Milk testing, standardization and preparation of different dairy products with its nutritive value and composition.

Course Objectives: The general objective of this course is to empower the learners with a basic understanding of the concepts, values, and virtues of Dairy Science, technology and skill development in dairy processing. Specifically, this course aims to –

a. Know basic concept of milk and milk properties and status of dairying in Nepal,
b. familiar with milk processing, quality testing, standardization and understand the processing of milk products, and
c. acquainted with indigenous dairy products, processing and their marketing in Nepal.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Leaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Status of Dairying in Nepal	1.1. Dairying in Nepal, its scope and comparison with developed countries	2:00	1.2. *Group Discussions*: Study of commonly used dairy equipment in lab and available dairy products in Nepal.	1:00	Banerjee, G.C. (2015) A Text Book of Animal Husbandry (8th Edition). Oxford and IBH Publishing. New Delhi.
		1.3. Concept and definition of milk and diagrammatic representation of milk constituents,	1:00	1.4. *Micro presentations:* Study of milk sampling procedures and sediment testing	1:00	Prasad, J. (2016) Animal Husbandry and Dairy Science (6th Edition). Kalyani Publishers, New Delhi, India.
II	Composition of milk & its property	2.1. Composition of milk in brief (fat, lactose, protein, enzymes, vitamins and minerals).	2:00	2.2. *Lab Work:* Estimation of Sp. gr. SNF and T.S. in milk by using milk lactometer	1:00	Wong NP, Jenness R, Kenney M & Elmer MH. (1988) Fundamentals of Dairy Chemistry. Van Norstand Reinhold Co.
		2.3. Nutritive value of milk	1:00	2.4. *Project Work:* Estimation of fat by Gerber's method in different milk samples.	1:00	Simpson, B.K., Nollet, L.M.L., Toldra, F. & Hui, Y.H. (2012). Food Biochemistry and Food Processing, John Wiley & Sons, Inc., 9600 Garsington Road, Oxford, UK, ISBN: 13: 978-0-8138-0874-1/2012.
		2.5. Physical and chemical properties of milk	1:00	2.6. *Lab Work:* Study of COB and Ethyl alcohol test (ethanol) for checking suitability of the milk for further processing	1:00	
		2.7. Factors affecting the composition of milk	1:00	2.8. *Project Work:* Study of MBR test for assessing microbiological quality of milk	1:00	Clarence, H.E., W.B. Combs and H. Macy. (1994) Milk and milk products. TATA, McGraw-Hill Publishing Company Ltd, India.

III	Clean milk production	3.1. Clean milk production & influencing factors, cleaning and sanitization of dairy plant	2:00	3.2. *Guided Discussions:* Estimation of titrable acidity of milk by titration method.	1:00	Nollet,L.M.L. & Toldra, F. (2010) Hand Book of dairy Foods Analysis, CRC Press, Taylor and Francis Group, 6000, Broken Sound Parkway, USA. Thiagarajan, T. (2015). Animal Husbandry Statistics and Computer Applications, Satish serial Publishing House, 403, express Tower, Azadpur, Delhi- 110003,India.
		3.3. Hand milking and machine milking methods and their importance in dairy farm. 3.5. Flavour defects in milk and their causes and prevention measures in brief	1.00 1.00	3.4. *Group practice:* Preparation and practices of hand milking for clean and sanitized milking in Nepal	1.00	
IV	Study of Mammary gland	4.1. Structure of mammary gland, external and internal features of mammary gland	2.00			Nickerson, S.C. & Akers, R.M. (2011). Mammary Gland; Anatomy, Growth & Development (2nd Edition), Elsevier Ltd., San Diego: Academic Press, USA
						Hui, Y.H. (1993). Dairy Science and Technology Hand Book, Wiley VCH, Inc. USA, ISBN:1-56081-078-5
V	Dairy Microbiology	5.1. Types of M.O. found in milk, their sources of contamination, uses and significance in dairy industry	2.00	5.2. *Lab Work:* Estimation of total bacterial counts in milk using SPC method	1.00	Robinson, R.K. (2002). Dairy Microbiology Handbook (3 rd Edition), John Wiley & Sons, Inc., 605 Third Avenue, NY 10158-0012, USA, ISBN: 0-471-38596-4. Tamime, A. Y. & Thomas, L.V. (2018). Probiotic Dairy Products (2 nd Edition), John Wiley & Sons, Inc. 111 River Street, Hoboken, NJ, 07030, USA, ISBN: 9781119214106.
		5.3. Probiotic bacteria and their	1.00			Srividya,A.R. & Vishnuvarthum,V.J. (2011). Probiotic:A rational approach

		importance in human health				to use Probiotic as medicine, International Journal of Pharmaceutical Frontier Research, 1(1), 126-134. Adam,J.K., Odhar, B. & Naidu, K>S.B.(2012). Probiotics:Recent Understanding and Biomedical applications, Journal of Current Trends in Biotechnology and Pharmacy, 6(1), 1-4.
VI	Milk processing	6.1.Dairy food chains, indigenous milk collection, processing and supply in community and market	1.00	6.2. <u>*Labwork:*</u> Study of cream separator, their parts and its assembling, and method of cream separation.	1.00	Agrawal, A.K. & Goyal, M.R. (2017). Processing Technology for Milk and Milk Products: Methods, Applications & Energy Usages, Apple Academic Press Inc., 3333 Mistwell Crescent, Oakville, Canada, ISBN: 13:978-1-315-20740-7.
		6.3. Milk purchasing, collection system, preservation and safe transportation in Nepal	1.00	6.4. <u>*Labwork:*</u> Preparation of concentrated dairy products (Ice cream and *Khoa*)	1.00	Sukumar, De. 2000. Outlines of Dairy Technology. By Oxford University Press. New Delhi, India.
		6.5. Receiving, weighing and sampling of milk, different platform and routine tests for maintenance of quality of milk	2.00	6.6. <u>*Labwork:*</u> Preparation of separated dairy products (Ghee, Butter, Skim milk)	1.00	Sukumar, De. 2000. Outlines of Dairy Technology. By Oxford University Press. New Delhi, India.
		6.7. Standard method of straining, filtration, clarification and bactofugation of milk	1.00	6.8. <u>*Labwork:*</u> Preparation of fermented dairy products (Yoghurt and Probiotic milk products)	1.00	Chandan, R.C. and K. Arun, (2013) Manufacturing Yoghurt and Fermented Milk, 2nd edition, Willey-Blackwell Publication, USA.

		6.9.Standard and indigenous milk cooling, homogenization & emulsification	1.00	6.10. *Labwork:* Preparation of coagulated indigenous dairy products (Chhana, Paneer, Cheese, Churpi etc)	1.00	Rani, V. & Yadav, U.C.S. (2018). Functional Food and Human Health, Springer Nature Singapore P (Ltd.), 152 Beach Road Gateway east, 189721- Singapore, ISBN; 978-981-13-1122-2.
		6.11. Milk pasteurization, sterilization and ultra-heat treatment, importance and explanation of methods with flow diagram,	2.00	6.12. *Methodology discussion:* Introduction (definition, nutritive values, uses and flow diagram of method of preparation) and preparation of powder milk	1.00	Sukumar, De. 2000. Outlines of Dairy Technology. By Oxford University Press. New Delhi, India.
		6.13. Milk packaging, storage and distribution systems in Nepal	1.00			Patel, H.G. & Modha, H. (2015) Packaging of Dairy Products, ICAR Publication, New Delhi, India, Pp 11-85, (www.AgriMoon.Com)
		6.14. Process of toning and standardization of market milk and problems related to it	2.00	6.15. *Group Discussions and Lab practice*: Study of common milk adulterants and their testing for safe milk for community	1.00	Razluddin, M. & Hembade, A. (2014) Milk and Milk Product Technology, Jaya Publishing House, Delhi-1-1005, India,
		6.16. Payment system of milk in Nepal & regional area	2.00	6.17. *Field trip:* A short visit to dairy processing plant nearby GSAF		Sukumar, De. 2000. Outlines of Dairy Technology. By Oxford University Press. New Delhi, India.
II	Project planning for Mini dairy Plant	7.1. Formulation of project for mini dairy plant and its management.	2.00			Patel, S.M. & Bhandania, A.G. (2019). Dairy Plant Design and Layout, AAU, Anand Gujrat, Hand Book, www.agrimoon.com
		Total hours of thematic teaching-learning	**32:00**	**Total hours of practical activities**	**16:00**	

3.1. Course Syllabus

Semester V

Course Code: ANS 455 *Credit Hours:* 3 [Theory: 1; Practical: 2]

Course Title: Fodder Production and Pasture Management *Teaching Hours:* 48

Course Description: This course covers the principles, practices, and technologies of fodder crop production and pasture management for sustainable livestock feeding. Emphasis is placed on species identification, cultivation practices, conservation techniques, and Nepal-specific forage issues.

Course Objectives:

Specifically, this course aims to –

a. familiarize students with the key terminologies and concepts of fodder and pasture science,
b. develop practical knowledge of fodder crop cultivation, pasture establishment, conservation techniques, and,
c. understand Nepal's feeding situation and strategies to improve forage availability.

Unit	Macro Level Contents	Micro Level Contents				Reference
		Theoretical Elements of Leaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction	1.1. Common terminology of fodder and pasture	1:00	1.2. *Lab work:* Familiarize with the common equipment used in animal nutrition laboratories	2:00	Allen, V. G., Batello, C., Berretta, E. J., Hodgson, J., Kothmann, M., Li, X., ... & Sanderson, M. (2011). An international terminology for grazing lands and grazing animals. *Grass and forage science*, *66*(1), 2. Singh, S. B., & Singh, N. (2019). Nepal livestock feed balance and strategies to address the feed deficit. *Journal of Agriculture and Forestry University*, *3*, 159-171. Malik, Z., Bashir, M. A., Abbasi, G. H., Ali, M., Akhtar, M. W., Adil, M., & Ahmad, M. (2021). Impact of Environmental and Edaphic Factors on Winter Fodders and Remedies. In *Sustainable Winter Fodder* (pp. 223-253). CRC Press.
		1.3. Feeds and feeding situation in Nepal		1.4. *Field visit:* Visit to different farms to observe the use of improved varieties of fodder and fodder trees	3:00	
		1.5. Edaphic factors affecting pasture and fodder crops				
		1.6. Chemical composition and nutritive value of fodder	1:00			
II	Fodder Plant Morphology and Growth	2.1. Fodder plant growth and development	1:00	2.2. *Field work*: Cultivation of different seasonal fodder and fodder trees to learn cultivation practices	10:00	Dhamodharan, P., Bhuvaneshwari, J., Sowmiya, S., & Chinnadurai, R. Revitalizing fodder production: Challenges and opportunities. Griffiths WM, Matthew C, Lee JM, Chapman DF. 2016. Is there a tiller morphology ideotype for yield differences in perennial ryegrass (Lolium perenne L.)? Grass and Forage Science 72: 700-713
		2.3. Morphology of forage grasses: vegetative grass tiller, and reproductive growth in forage grasses	2:00			
III	Cultivation Practices of Fodder Crops	Oats	1:00	2.4. *Group work*: Preparation of herbarium of different fodder, fodder trees, and pasture species	5:00	Hilli, H. J., & Kapoor, R. (2023). Forage production in india: Bottlenecks and opportunities by opening up new way with an increase in fodder oats demand: A review. *Asian Journal of Dairy and Food Research*, *42*(3), 275-285.

		Teosinte	1:00			Devkota, N. R., Ghimire, R. P., Adhikari, D. P., Upreti, C. R., Poudel, L. N., & Joshi, N. P. (2017). Research Article FODDER PRODUCTIVITY OF TEOSINTE (Euchlaena mexicana Schrad) AT DIFFERENT SOWING DATES IN WESTERN MID-HILLS OF NEPAL. *Journal of Agriculture and Forestry University*, *1*, 129. Islam, S., Sultana, S., Islam, M. A., Yasmin, S., Amin, M. R., Islam, M. S., & Khatun, R. (2024). Comparative Profitability of Napier Palsaniya, D. R., Kumar, S., Shivkumar, B. G., Ram, S. N., & Ghosh, P. K. (2017). Stylosanthes Production, Processing and Utilization Technologies for Animal Production-A Review. *Animal Nutrition and Feed Technology*, *17*(3), 501-514.
		Napier	1:00			
		Berseem	1:00			
		Stylosanthes	1:00			
		Lucern	1:00			
IV	Pasture Establishment and Management	4.1. Red clover	1:00	4.2. <u>*Group work*</u> Collection of fodder and fodder trees from the Ramghat premises and preparation of a report	5:00	Boller, B., Schubiger, F. X., & Kölliker, R. (2010). Red clover. *Fodder crops and amenity grasses*, 439-455. Caradus, J. R., Woodfield, D. R., & Stewart, A. V. (1995). Overview and vision for white clover. *NZGA: Research and Practice Series*, *6*, 1-6. Humphreys, M., Feuerstein, U. L. F., Vandewalle, M., & Baert, J. (2009). Ryegrasses. In *Fodder crops and amenity grasses* (pp. 211-260). New York, NY: Springer New York.
		4.3. White clover	1:00			
		4.4. Perennial rai grass	1:00			
V	Fodder and Pasture	5.1. Hay making: steps, advantages, and disadvantages	1:00	5.2. <u>*Group work*</u> Conservation techniques for different fodder species	7:00	Williams, G. F. (1975). Advantages and disadvantages of hay cubes.

	Conservation Techniques	5.3. Silage making: process, steps, advantages, and limitations	1:00			Mahanna, B., & Chase, L. E. (2003). Practical applications and solutions to silage problems. *Silage science and technology, 42*, 855-895.
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**32:00**	

3.1. Course Syllabus

Semester VI

Course Code: ANS 465 *Credit Hours:* 2 [Theory: 1; Practical: 1]

Course Title: Animal Breeding and Biotechnology *Teaching Hours*: 32

Course Description: Introduction to the history and importance of animal breeding; current livestock improvement programs in Nepal; common terminologies used in animal breeding. Genetic resources of Nepal and Karnali province; conservation of indigenous breeds; rare breeds and their economic values in Nepal. Physical basis of inheritance and basic principles of genetics; variations and causes of variation (heredity and environment); gene action (additive and non-additive); concept of heritability and repeatability. Principles, methods, and basis of selection; selection differential, response, and intensity; mating systems: inbreeding, outbreeding, crossbreeding, and hybridization. Hormonal mechanisms in growth, lactation, and reproduction; male and female reproductive systems; estrus detection, induction, and synchronization; artificial insemination (AI) and embryo transfer techniques. Nuclear transplantation and transgenic animal production; recent advances in animal biotechnology. Phenotypic expression of genes (gene action): additive and non-additive (dominance, over-dominance, incomplete dominance, co-dominance, epistasis, and transgressive

variation). Concept of genetic resistance to diseases and parasites; methods to enhance genetic resistance. Selection for qualitative and quantitative traits; traits of economic importance in livestock and poultry. Techniques in animal biotechnology: genetic engineering, molecular markers, and cloning. Current animal breeding researches in Nepal, their concepts, objectives, and methods.

Course Objectives: –

a. To understand the basic principles and fundamentals of animal breeding and biotechnology;
b. apply animal breeding techniques in livestock improvement, and,
c. understand the importance of genetic resources and sustainable development in animal breeding.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Leaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Basics of Animal Breeding	1.1. History and importance of animal breeding	1:00			Lasley, J. F. (1988). Genetics of livestock improvement (4th ed.). Prentice Hall. Warwick, E. J., & Legates, J. E. (1979). Breeding and improvement of farm animals (7th ed.). McGraw-Hill Book Company.
		1.2. Common terminologies and livestock improvement programs in Nepal				
		1.3. Genetic resources of Nepal and Karnali Province				
		1.4. Conservation of indigenous and rare breeds, and their economic value	1:00	1.5. *Group work* : Farm data analysis and report writing	1:00	
II	Genetic Principles and Variations	2.1. Basic principles of genetics and inheritance	1:00			Hutt, F. B. (1982). Genetics of the fowl (2nd ed.). Norton Creek Press. Falconer, D. S., & Mackay, T. F. C. (1996). Introduction to quantitative genetics (4th ed.). Longman.
		2.2. Gene action: additive, non-additive, dominance, co-dominance, epistasis	1:00			
		2.3. Variations due to heredity and environment	1:00			
		2.4. Concept of heritability and repeatability	1:00	2.5. *Class discussion* : Estimation of heritability and repeatability	1:00	

			1:00	2.6. *Class discussion:* Estimation of variance, breeding values, PBA, MPPA	2:00	
III	Selection and Breeding Systems	3.1. Principles and methods of selection	1:00			Johansson, I., & Rendel, J. M. (1968). *Genetics and animal breeding*. Oliver & Boyd. Bourdon, R. M. (2000). *Understanding animal breeding* (2nd ed.). Prentice Hall.
		3.2. Selection differential, response, intensity	1:00			
		3.3. Mating systems: inbreeding, outbreeding, crossbreeding, hybridization	1:00			
		3.4. Selection index and estimation of genetic gain	1:00	3.5. *Lab work*: Estimation of selection index and parameters	1:30	
		3.6. Inbreeding relationship and coefficient	1:00	3.7. *Group work*: Calculation of inbreeding coefficient and relationship	1:30	
IV	Reproduction and Biotech Tools	4.1. Reproductive anatomy and hormonal regulation	1:00			Hafez, E. S. E. (1989). *Reproduction in farm animals* (5th ed.). Lea & Febiger. Nagabhushanam, R., Kodarkar, M. S., & Sarojini, T. (1999). *Textbook of animal physiology*. Oxford & IBH Publishing.
		4.2. Estrus detection, induction, synchronization	1:00	4.3. *Farm work*: Estrus detection and palpation	1:00	
		4.4. Artificial insemination and embryo transfer		4.5. *Farm work*: Semen collection (AV), preservation, thawing	2:00	
		4.6. Cloning, transgenic animals, genetic engineering, molecular markers	1:00	4.7. *Lab work*: Embryo collection, synchronization, transfer	2:00	
V	Traits, Resistance & Trends	5.1. Phenotypic expression: additive, dominance, epistasis	1:00			Lasley, J. F. (1988). *Genetics of livestock improvement* (4th ed.). Prentice Hall. Bourdon, R. M. (2000). *Understanding animal breeding* (2nd ed.). Prentice Hall.
		5.2. Selection for qualitative and quantitative traits	1:00			
		5.3. Economic traits in livestock and poultry				
		5.4. Genetic resistance to diseases and parasites				
		5.5. Emerging trends in animal breeding		5.6. *Group work*: Case studies, discussions on biotech trends	4:00	
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	16:00	

3.1 Course Syllabus

Semester VII

Course Code: ANS 474

Credit Hours: 2 [Theory: 1; Practical: 1]

Course Title: Meat and Wool Production Technology

Teaching Hours: 32

Course Description General overview of meat and wool production, importance and improvement of current situation, Structure, composition and nutritive value of meat, Processing of meat and its product in Nepal, Sausage production technology, Sensory evaluation of meat and its products in Karnali, Sheep raising techniques and farm management, Development and growth of wool, Grading, Post shearing operations and quality assurance, Wool size measurements and maintenance of quality of wool goods.

Course Objectives: The general objective of this course is to empower the learners with a basic understanding of the concepts, values, and virtues of Dairy Science, technology and skill development in dairy processing. Specifically, this course aims to –

a. know the basic concept of meat and wool production and their status in Nepal,
b. familiar with meat and wool processing techniques and its quality assurances, and
c. acquainted with indigenous meat and wool products, processing and their marketing in Nepal

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Leaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I.	Status of meat and wool production in Nepal	1.1. Meat and wool production in Nepal and abroad, their importance, constraints and solution.	2:00	1.2. *Group Discussions*: Study of commonly used meat and wool equipment in lab and available meat and wool products in Nepal.	2:00	Feiner, G. (2006). Meat products hand book: Practical science and Technology (1st Edition). Wood head Publishing Ltd., Cambridge CBI 64 H. England, pp 1-671.
		1.3 Related terminology of meat and	1:00	1.4. *Micro presentations:* Maintenance of slaughter house	1:00	HUI, Y.H. (2012). Hand book of

		wool production.		and sample preparation of meat.		
II.	Composition, Quality Testing, and Processing of Meat	2.1. Structure, composition and nutritive value of meat tissues.	1:00	2.2. *Lab work:* Study of dye reduction test and moisture determination in meat.	2:00	Lawrie, R.A. and Ledward, D.A. (2006). Lawrie's Meat Science, 7 th edition, Woodhead publishing Limited, ISBN: 13: 978-1-84569-159-2, Cambridge, CBI 6 AH, England, pp 1-461. FS, Technology of Animal Products Lab (2021). Laboratory Manual, Pondicherry University, Punducherry-605014, pp 1-81. Herenda, D. (2000). Manual on Simple Methods of Food Preservation, FAO Publication, ISBN: 92-5102744-7, FAO, Rome, Italy, pp 1-94. Heinz, G. and Hautzinger, P. (2007). Meat Processing Technology, FAO, Regional Office for Asia and The pacific, ISBN: 978-974-7946-99-4, Bankok-10200, Thailand, pp 1-470. Worriss, P.D. (2000). Meat Science: An introductory Text, CABI Publishing, Wallingford, UK, ISBN: 0851994245, pp 1-320. Kumari, S. (2021). Quality Evaluation of Meat Products, Meat Science, Department of LPT, B.V,
		2.3. Different parameters of meat quality.	1:00	2.4. *Project Work:* Study of methods of Meat Preservation.	1:00	
		2.5. Processing of meat and meat products in Karnali province.	1:00	2.6. *Group practice:* Slaughter procedures and methods of stunning of animals for meat processing.	1:00	
		2.7. Sausage production and its importance in Nepal.	1.00	2.8. *Lab work:* Study of various steps involved in sausage preparation in Nepal. 2.9. *Guided Discussions:* Biosecurity and meat inspection procedures for clean and safe meat production.	1.00	

		2.10. Sensory evaluation of meat and meat products.	1.00	2.11. *Lab work* Sample Preparation and Sensory Evaluation of Meat.	1.00	Sc., Bihar Animal Sciences University, pp 1-20.
III	Sheep raising techniques	3.1. Sheep raising techniques and farm management in Nepal.	2.00	3.2. *Group practice & discussion.* Study of picking, casting, skirting and removal of backs for quality wool production.	2.00	Simpson, W.S.and Crawshaw, G.H. (2002). Wool Science and Technology, Woodhead Publishing Ltd., Abington Hall, Cambridge, CBI 6 AH, England,
		3.3. Types of wool production and it's characteristics.	1.00			Shinde, A.K., Gadakar, YP, Jyotsene, B., Mahapatra, A and Naqvi, S.M.K. (2011). Latest Sheep Technology and Innovation: Meat, Wool and Milk, ICAR Central Sheep and Wool Research Institute, Avikanagar 304501, Rajasthan, India, pp 1-96.
IV	Wool Growth, Processing, and Measurement	4.1. Development and growth of wool from Sheep.	1.00	4.2. *Lab work:* Study of quality parameters of fibber, yarn and fabrics for wool production.	1.00	Johnson, N.A.G. and Russell, I. (2008). Advances in Wool Technology, ELSEVIER Pub. e-Book, Chemical engineering, ISBN:9781845695460, Woodhead Publishing printing, pp 1-368.
		4.3. Classification and grading of wool.	1.00	4.4. *Lab work:* Study of sampling, grading and scoring of wool for quality testing.	1.00	Mahapatra, G. (2021). Wool Grading Systems, Department of Livestock Products Technology, Bihar Veterinary College, LPT Unit 111, pp 1-15.
		4.5 Post shearing operations of wool and quality assurance in Nepal.		4.6. *Group practice:* Study of diversification of wool products and	1-00	Popescu, C. and Watermann, F.J. (2021). Wool Structure, Mechanical Properties and Technical Products

				application.		based on Animal Fibres, www.researchgate.net Chapter 12, pp1-13.
		4.7. Post shearing operations of wool and quality assurance in Nepal.	1.00	4.8. *Project Work:* Study of waste management of slaughtering house, sheep manure and wool waste in Karnali province.	1.00	Kadam, V., Soni, A., Phand, S., and Kumar, A. (2021). Sheep, Wool and Mutton Production and Value addition, ICAR-CSWRI, Hyderabad, India,
		4.9. Wool size measuring techniques, quality assurance and maintenance of wool goods.	2.00	4. 10. *Field trip:* A short visit to meat and wool processing plant nearby GSAF.	1.00	Peter, R.L. (2003). Handbook of Yarn Production: Technology, Science and Economics, Woodhead Publishing Ltd., Abington, Cambridge, CBI 6 AH, England, pp1-465
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**16:00**	

3.1 Course Syllabus

Semester IV

Course Code: AQU449
Course Title: Fundamentals of Aquaculture
Credit Hours: 2 [Theory: 1.0; Practical: 1.0]
Teaching Hours: 32
Course Description: This course comprises learning of basic concepts of fish biology, water quality management, pond management, fish farming system, fish breeding, fish diseases, fish market and transportation.

Course Objectives: The general objective of this course is to empower the learners with a basic understanding of the fish biology, management practices, farming system, breeding technique and market status. Specifically, this course aims to –

a) describe biology of cultivable and cultivated fish species and their management practices,
b) delineate different farming system and breeding technique, and
c) identify diseased fish and their management practices.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction to Aquaculture	1.1. Meaning and concepts of aquaculture and Desirable characters of fish for culture	1:00			Shrestha, T.K., & Jha, D.K. (1993). *Introduction to Fish culture.* TU, IAAS, Rampur. Pillay, T.V.R., & Kutty, M.N. (2005). *Aquaculture Principles and Practices.* Garsington Road Oxford,U.K.:Blackwell publishing. Woynarovich, E. (1975). *Elementary Guide to Fish Culture in Nepal.* FAO, Italy, Rome.
		1.2. Biology of cultivated fish species: Morphological characters, feeding habits, growth rate and reproductive behaviour of Common Carp, Chinese Carp and Indigenous major carps, Nile Tilapia, Trout, Catfishes(Pangas, Mangur), Sahar, Silver Barb and Freshwater prawn	1:00	1.3. *Micro presentation:* Organize micro presentation on biological characteristics of cultivated fish species and their identification by morphological observation.	1:00	

II		2.1 Physical Parameters- Temperature and Turbidity, Chemical Parameters- Dissolved oxygen and pH, and Biological Parameters- Plankton	1:00	2.2. *Field work:* Organize the field work for Measurements of temperature and transparency (turbidity) of water of GSAF.pond.	1:00	Shrestha, T. K., & Jha, D. K. (1993). *Introduction to Fish Culture*. TU, IAAS, Rampur. Pillay, T.V.R., & Kutty, M.N. (2005). *Aquaculture Principles and Practices.* Garsington Road Oxford, U.K.:Blackwell publishing. Lucas, J.S., & Southgate P.C. (2012). *Aquaculture: Farming Aquatic Animals and Plants* (2nd. ed.). Wiley- Blackwell. Jha, D.K. & Ranjan Rahul (2019). Laboratory Manual of Aquaculture, AFU, Rampur, Chitwan, Nepal.
	Water quality and Pond Management	2.3. Water quality in Ponds rivers and lakes and their management, waste reuse and recycling	1:00	2.4. *Field work:* Organize the field work for Measurement of DO and pH of water of GSAF pond.	1:00	Shrestha, T. K. and Jha, D. K. (1993). *Introduction to Fish Culture*. TU, IAAS, Rampur. Shafi, S. (2003). *Applied Fishery Science*. New delhi: Atlantic publisher and distributors. Jha, D.K. and Ranjan Rahul (2019). *Laboratory Manual of Principles of Aquaculture*, AFU, Rampur, Chitwan, Nepal.
		2.5. Introduction of biofloc, and aquaponics, advantages and disadvantages	1:00	2.6. *Desk Research:* Search on the Internet and other sources to know about the Biofloc and Aquaponics technology and their Scope and Possibilities in Nepal.	0:30	Neupane, P., Adhikari, M., Thapa, M. K., & Pandeya,A. K. (2020). Bio-floc technology:Prospects and Challanges in Fish Farming in Nepal. *International Journal of Applied Science and Technology, 8(2)*, 140-145.

						Subedi, B., & Paudel, M. (2020). Aquaponics: Prospects & Challanges in Nepal. *International Journal of Environment Agriculture and Biotechnology, 5(4)*, 1183-1187.
		2.7. Site selection for Pond construction	1:00	2.8. *Field work and Group discussion:* Organize the field work for measurement of a typical Pond and discussion on the different types of Ponds	1:00	Shrestha, T. K. & Jha, D. K. (1993). *Introduction to Fish Culture*. TU, IAAS, Rampur. Lucas, J.S., & Southgate, P.C. (2012). *Aquaculture: Farming Aquatic Animals and Plants* (2nd. ed.). Wiley- Blackwell. FAO. (1945). *Aquaculture Methods and Practices*: A selected Review. Shafi, S. (2003). *Applied Fishery Science.* New delhi: Atlantic publisher and distributors. Jha D.K. & Ranjan Rahul (2019). Laboratory Manual of Principles of Aquaculture, AFU, Rampur, Chitwan, Nepal.
		2.9. Liming and fertilization, aquatic weed and predator's control, essential nutrients and their requirement to the fish,	1:00	2.10. *Guided discussion:* Facilitate class discussion on the method of pond Liming and fertilization technique adopted in Nepal and illustrate numerical calculation.	1:30	
		2.11. Introduction to Feed Digestibility (FD), FCR, FCE, PER. feed and feeding, Natural and artificial feed: introduction and application	1:00	2.12. *Group discussion and problem solving:* Discussion on the method of feed formulation and feeding and illustrate numerical calculation.	1:00	
III	Fish Farming System	3.1. Definition, concept and Classification On the basis of Intensity, Enclosure, Fish Species, and Integration.	2:00	3.2. *Thematic presentation*: Divide the topic regarding different Fish farming system to students and organize the presentation. 3.3. *Brainstorm:* Organize a brainstorming session to	1:00	Shrestha, T. K. and D. K. Jha (1993). *Introduction to Fish Culture*. TU, IAAS, Rampur. Lucas, J.S., & Southgate, P.C. (2012). Aquaculture: Farming Aquatic Animals and Plants (2nd. ed.). Wiley- Blackwell. Woynarovich, E. (1975). *Elementary Guide to Fish Culture in Nepal.*

				discuss the different fishing gears, nets and their uses in aquaculture.		FAO, Italy, Rome. Pillay, T.V.R., & Kutty, M.N. (2005). *Aquaculture Principles and Practices.* Garsington Road Oxford, U.K.:Blackwell publishing.
				3.4. *Desk Research:* Search on the Internet and other sources to know about different Harvesting method and Post-Harvest Technology.	1:00	
IV	Fish Breeding and Marketing	4.1. Introduction: Brood fish and their sexual differences, Basic principles, Broodstock Management	1:00	4.2 *Group Discussion:* Organize a group discussion on the method of Identification of Brood fish.	1:00	Shrestha, T. K., & Jha, D. K. (1993). *Introduction to Fish Culture.* TU, IAAS, Rampur. Shafi, S. (2003). *Applied Fishery Science.* New delhi: Atlantic publisher and distributors. Woynarovich, E. (1975). *Elementary Guide to Fish Culture in Nepal.* FAO, Italy, Rome. Pillay, T.V.R., & Kutty, M.N. (2005). *Aquaculture Principles and Practices.* Garsington Road Oxford, U.K.:Blackwell publishing.
		4.3. Breeding Process of Common carp, Chinese carp and Indigenous carp in Nepal	1:00	4.4. *Lab Experiments:* Divide 2-5 students in a group and guide them for dissection to Collect and preserve fish pituitary gland.	1:00	
		4.5. Transportation practice, Principles and Method of fish preservation and their significance in Nepal	1:00	4.6. *Lab Experiments:* Observation and Examination of experimental fish skin and gills.	1:30	
		4.7. Status of Aqua-Business and fish Marketing.	1:00	4.8. *Trip:* Visit the nearby fish market in your locality and prepare a report.	1:30	
V	Fish Diseases and their Management	5.1. Infectious disease fish (Causal organisms, Symptoms and Preventive measures- Sprolegniasis, Tail rot/fin rot, White spot, Dactylogyrosjs, Gyrodactylosis, Argulosis, Lernaeosis	1:30	5.2. *Group Discussion:* Discussion on the behavioral signs of diseased and healthy fish.	1:00	Shrestha, T. K., & Jha, D. K. (1993). *Introduction to Fish Culture.* TU, IAAS, Rampur. Pillay, T., & Kutty, M. (2005). *Aquaculture Principles and Practices.* Garsington

		Asphyxiation)				Road Oxford, U.K.:Blackwell publishing. Noga, E.J. (2010). Fish Diseases Diagnosis and Treatment. Wiley-Blackwell publishing, Inc.
		5.3. Non- infectious diseases of fish (Sign and Symptoms and Preventive measures- Asphyxiation, Gas bubble)	0:30	5.4. *Guided Discussions:* Facilitate class discussions on common drugs and chemicals used in fish health management. Encourage students to explore their uses.	1:00	Shafi, S. (2003). *Applied Fishery Science.* New delhi: Atlantic publisher and distributors. CFPCC, (2018). Annual book. Balaju, Kathmandu: Government of Nepal; Ministry of Agriculture and livestock Department, Department of livestocks. Central Fisheries Promotion and Conservation Centre.
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**16:00**	

Course Syllabus

Semester VII

Course Code: AQU 478 *Credit Hours:* 3 [Theory: 1; Practical: 2]
Course Title: Introductory fish and fisheries *Teaching Hours:* 48

Course Description: This course focuses on definition of Fish and Fishery, Taxonomy, Diversity and Biology of Fish, Economic importance of fish, Study of different organ systems- Morphology and Anatomy, skin scales and fins, Digestive, Respiratory, Circulatory, Nervous and Reproductive systems, Riverine Fisheries of Nepal and Fish Migration.

Course Objectives: The general objective of this course is to empower the learners with a basic understanding of the taxonomy, fish diversity, anatomy and biology of fin fishes, specifically, this course aims to –

a. Describe fish characters, its importance and scope,
b. identify morphological and anatomical structures of fish (morphometric and meristic count) and major taxa of inland fishes up to order level, and
c. delineate different organs, functions and systems of fish;

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Taxonomy, Diversity and Biology of Fish	1.1 Definition of fish, fishery and other related terms, concept about Fresh water and marine fish, cold water and warm water fish species, Economic importance of fish	1:00	1.2 *Field work*: Methods of collection and Preservation of Fishes.	2:00	Shrestha T.K. (2019), *Ichthyology of Nepal*. B.J. Shrestha publisher. Pandey K. & J.P. Shukla (2007) *Fish & Fisheries* (2nd Edition). Rastogi Publication, Shivaji Road, meerut-25002, India.524p. Jayaram K.C. (2022) *Fundamentals of Fish Taxonomy*. Narendra Publishing House, New Delhi India.
		1.3 Outline classification of fishes up to order	1:00	1.4 *Group Discussion:* Identification between Bony and Cartilaginous fishes	1:00	
		1.5 Fish species found in High hills, Mid hills and Terai region of Nepal	1:00	1.6 *Desk Research and Group Discussion:* Compare the fish species found in High hills, mid hills and Terai region of Nepal.	2:00	Khanna S.S. & H.R. Singh. (2013). *A Textbook of Fish Biology and Fisheries* (Corrected Edition). Narendra Publishing House, Delhi-110006, India.524p.

				1.7 *Desk Research and Group Discussion:* Study of Indigenous and Exotic fish species found in various water resources of Karnali Province	2:00	Jha, D.K. & Ranjan Rahul (2019). Laboratory Manual of Aquaculture, AFU, Rampur, Chitwan, Nepal. Pandey K. & J.P. Shukla (2007) *Fish & Fisheries* (2nd Edition). Rastogi Publication, Shivaji Road, meerut-25002, India.524p.
		1.8 External features, shape and size, structure and functions of skin, scales and fins.	1:00	1.9. *Group Practice*: Study of morphological identification of indigenous fishes of Nepal	2:00	
		1.10 Introduction to Morphometric measurements and Meristic counts, fin formula	1:00	1.11 *Guided Discussion and practice*: Study of different types of Fins and Barbels	2:00	
				1.12 *Guided Discussion*: Study of different types of Scales	1:00	
				1.13. *Guided Discussion and practice*: Count of Lateral Line	1:00	
II	Anatomy of Fish	2.1. Study of different internal organs, their location and functions	2:00	2.2. *Thematic Discussion and Lab experiment:* Study of Anatomy of Fish	2:00	Shrestha, T. K. and Jha, D. K. (1993). *Introduction to Fish Culture*. TU, IAAS, Rampur Kumar S. & M. Tebhre. (1996). *Anatomy and Physiology of Fishes*. Vikash Publishing House Pvt. Ltd., New Delhi, India.275p.
				2.3. *Lab experiment:* Study of Gills in Fish	1:00	

III	Different Organ Systems of Fish	3.1 Digestive System: Structure and functions of alimentary Canal	1:00	3.2 *Lab experiment:* Study of Alimentary Canal of different kinds of Fishes	2:00	Khanna S.S. & H.R. Singh. (2013). *A Textbook of Fish Biology and Fisheries* (Corrected Edition). Narendra Publishing House, Delhi, India. 524p. Pandey K. & J.P. Shukla (2007) *Fish & Fisheries* (2nd Edition). Rastogi Publication, Shivaji Road, meerut-25002, India.524p.
		3.3. Respiratory System: Structure and functions of Gills	1:00	3.4. *Brainstorm:* Study of accessory respiratory organs in air breathing fishes	2:00	Currie S. & D.H. Evans. (2021).*The Physiology of Fishes* (5th edition).CRC Press.
		3.5. Circulatory System: Structure and functions of Heart	1:00	3.6. *Thematic discussion and Lab experiment:* Study of Heart of Fish	1:00	
				3.7. *Lab experiment:* Study of temporary mount of blood smear, gill filaments and scales.	2:00	
		3.8. Nervous system: structure and function of pituitary organ	1:00	3.9. *Thematic discussion and Lab experiment:* Study of brain of fish	1:00	
		3.10. Reproductive System: Structure and functions of Gonads	1:00	3.11. *Micro presentation:* Study of male and female reproductive organs	2:00	
IV	Riverine Fisheries of Nepal	4.1. Ecology of Riverine Environment	1.00	4.2 *Field visit:* Comparative analysis of water quality parameters of stagnant and flowing water in Nepal	2:00	Mallin M.A. (2023). River Ecology. Oxford University Press.432p Hughes J. M. R., (2018). Fresh Water Ecology and Conservation. Oxford University Press.464p Angelier, E. (2003). *Ecology of*

						Streams and Rivers. Science Publishers, Inc., Enfield. pp. 215. Hawkes, H.A. (1975). *River zonation and classification.* River ecology. Blackwell. pp. 312–374. Rajbansi, K.G. (2012*). Biodiversity and Distribution of Freshwater Fishes of Central/Nepal Himalayan Region.* NEFIS 2013.
		4.3. Characteristics of Rivers and Lakes	1:00	4.4. *Group Discussion:* Classify Rivers and Lakes	1:00	Kamboj V. *et al.*, (2020). *A review on general characteristics, classification and degradation of river systems.* In: Environmental Degradation: Causes and Remediation Strategies. Chapter 4. DOI: 10.26832
		4.5. Fish Migration	1:00	4.6. *Thematic Presentation:* Study on migratory species: Catadromous, Anadromous and Amphidromous	2:00	Lucas M.C. *et. al.*, (2001). *Migration of Freshwater Fishes*. Black well science Ltd.
		4.7. Dams and their effects on fish migration	1:00	4.8. *Desk Research:* Study of fish ladder and dam of river.	1:00	
	Total hours of thematic teaching-learning		**16:00**	**Total hours of practical activities**	**32:00**	

MID-WEST UNIVERSITY
Birendranagar, Surkhet, Nepal

Syllabus for Common Foundation Course (CFC)
Semester I
2022

Course Code: CFC410
Course Title: Moral Education and Life Skill Development
Nature of the Course: Theory and Practical
Level: Bachelor

Credit Hours: 1.5 [Theory: 0.5; Practical: 1.0]
Teaching Hours: 24

Course Description: This course comprises of learning of basic concepts of moral education and life skill development essential for transforming ethical values, virtues, and life cherishing skills among the learners.

Course Objectives: The general objective of this course is to empower the learners with basic understanding of the concepts, values and virtues of moral education and life skill development. Specifically, this course aims to –

a. impart among the learners with basic concepts of moral education,
b. transform pragmatic life skills, and
c. promote ethical professionalism in them.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Leaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Basic Concepts of moral education	1.1. Meaning, values, and virtues of moral education and ethics; approach to learning values.	0:30	1.2. Facilitate group discussions on applications of moral education in life, organizations, and the society.	2:00	Hand, M. (2018). A theory of moral education. Routledge Taylor and Francis Group. ISBN 9781138898547.
		1.3. Relationship of moral education with life, nature, and the world of works; Principles of moral education [Justice, compassion, courage, creativity, kindness, loyalty, integrity, joy, hope, and respect].	1:00	1.4. Organize micro presentations on examples of ten selected principles of moral education that would shape up one's life and the world of works.	2:00	Gardner, R., Cairns, J., & Lawton, D. (2000). Education for Values: Morals, ethics, and citizenship in contemporary teaching. London: Kogan Page.
		1.5. Key elementsof moral education [civic education, public education, religious education, moral judgement, and moral development]; Four pillars of moral education [character and morality, individual and community, civic	1:00	1.6. Organize a brainstorming session to discuss the benefits of moral education and consequences in absence of moral education.	1:00	Rachels, J. (2018). The e*lements of moral philosophy*. (9th ed.). ISBN 0-07-282574-X. Nucci, L, & Narvaez, D. (eds.). (2014). Handbook of Moral and Character Education. Routledge Taylor and Francis Group. ISBN

		education, and cultural education]; Triangular relations of moral education [values and virtues, responsive citizenship behavior, and morality].				9780415532389. Naagarazan, R. S. (2002). A textbook on professional ethics and human values. New Delhi: New Age International Pvt. Ltd. ISBN (13) : 978-81-224-2301-3.
II	Introduction to life skill development	2.1. Meaning, nature, and significanceof life skill development; important areas of life skill development.	0:30	2.2. Organize group simulations on different skills required to manage a household, a local youth club, a classroom, a sports team, and a coffee shop; help the learners derive a list of skills required in common and try to relate them as skills required for managing life.	2:00	Nawale, A. M. (2018). An introduction to life skills: A textbook for college students. Kelly-Plate, J., Eubanks, E., &McGraw-Hill. Applying life skills. (8th ed.). ISBN-13: 978-0078744358.
		2.3. Role of public, private and development sector on life skill development among youth; selected institutions supporting in life skill development.	1:00	2.4. Search on the Internet and other sources to identify a list of life skill development training service provider organizations in the locality and understand various types of skills needed in life.	2:00	
		2.5. Areas of life skill development a. Setting objective of life and career planning b. Socialization and working in peer circles and groups c. Household management d. Respect for social values, norms, practices and traditions e. Livelihood managementat home and the society f. Awareness of civic duties and responsibilities	2:00	2.6. Facilitate the students work in groups of 3-5 members to perform micro projects on developing a checklist of 3-5 skill actions required to accomplish the six thematic areas of skill development discussed in previous topic 2.5. Organize a class presentation at the end.	3:00	
		2.7. Process of life skill development training Step I: Determine the target groups and assess the training needs Step II: Assign the experts to develop the training methods and materials Step III: Deliver the training	1:00	2.8. Organize a training workshop for the students on any one of the thematic areas discussed in topic 2.5 above following a five-step process as discussed in topic 2.7.	2:00	

		Step IV: Evaluate the transfer of training Step V: Derive the lessons learnt and best practices				
III	Outcomes of learning moral education and life skills	3.1. Outcomes of moral education and ethics: - Improved beliefs and values towards social institutions, traditions, and practices - Transformation of ethical, citizenship behavior - Development of moral attitude, personal identity, and integrity	0:30	3.2. Facilitate class discussions on exploration of outcomes of moral education at individual level. Encourage students to explore illustrative examples of outcomes.	1:00	*Sari, N.* (2013). The importance of teaching moral values to the students. Journal of English and Education, 2013, 1(1), 154-162. Available at: 192566-EN-the-importance-of-teaching-moral-values.pdf (neliti.com). Genesis University. (2022). The importance of moral education. Available at: GENESIS UNIVERSITY | 100% Online Education - Anytime and Anywhere. Sheikh, M. M. (2015). Core life skill development: Relevance and importance. Available at: (45) CORE LIFE SKILL EDUCATION: RELEVANCE AND IMPORTANCE | MUSTAFA MAJID - Academia.edu
		3.3. Outcomes of life skill development: - Self-awareness and empathy - Creative and critical thinking - Decision-making and problem-solving - Communication and interpersonal skills - Coping with emotions and stress	0:30	3.4. Facilitate class discussions on exploration of outcomes of moral education at group or institutional level. Encourage students to explore illustrative examples of outcomes.	1:00	
Total hours of thematic teaching-learning			**8:00**	**Total hours of practical activities**	**16:00**	

Semester I

Course Code: CFC411
Course Title: Basic English
Nature of the Course: Theory and Practical
Level: Bachelor

Credit Hours: 1 [Theory: 0.5; Practical: 0.5]
Teaching Hours: 16

Course Description:

The Basic English Course (CFC 411) is designed based on principles of developing the fundamental concept of English grammar, vocabulary, pronunciation, punctuation and write simple composition in English. The course is theoretical and practical in nature as it exposes both the basic rules of grammatical aspects of English language with their application in real context. It is designed to enable the students to be able to use English accurately and appropriately in both oral and written communication in various social, academic, and professional settings.

Objectives of the Course:

At the end of course, students will be able to understand the following basic general objectives:

- Use basic English grammar accurately and appropriately in both oral and written communication.
- Use vocabulary in oral and written communication in English.
- Write basic composition in English.
- Participate in various social, academic, and professional communications in English.

Course Contents:

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture Hour	Practical Elements of Learning	Lecture Hour	
I	English Grammar	1.1 Parts of Speech: Noun, pronoun, verb, adjective, adverb, article preposition, conjunction, interjection	2	1.1 MCQ–based exercises related to parts of speech	2	Sargeant, H. (2007). *Basic English grammar for English language learners book 2*. Saddleback Educational

		1.2 Sentence Structure: Tense, Conditional sentence, Subject-Verb Agreement, Voice, Reported Speech, and Transformations	2	1.2 MCQ-based exercises related to Sentence Structure	2	Publishing. Seaton, A., & Mew, Y. H. (2007). *Basic English Grammar-Book 1.* Saddleback Educational Publishing.
II	Vocabulary	Basic vocabulary • Synonyms • Antonyms • Phrasal Verbs • Idioms • Homonyms	1	Quiz Contest based on basic vocabulary	1	Marks (2007): English Vocabulary in Use. Cambridge University Press, Cambridge. McCarthy, M., & O'dell, F. (2010). *English Vocabulary in use Elementary with answers.* Cambridge University Press. Oxford Dictionary of Idioms (Judith Siefring) (z-lib.org)
III	Pronunciation	English sound system: • Vowels • Consonant • Stress • Intonation • Connected speech	1	Oratory competition & conversation in the given local context	1	Collins, B., & Mees, I. M. (2013). *Practical phonetics and phonology: A resource book for students.* Routledge. O'Connor, J. D. (1998). *Better English Pronunciation.* Cambridge University Press.
IV	Composition	4.1Basic punctuation: Capitalization, Full Stops (.), Comma (,), Colons (:), Semi-colons (;), Question Marks (?), Apostrophes ('), Hyphens (-) etc.	1	Exercise using punctuation marks in given texts	1	Bailey, S. (2017). Academic writing: A handbook for international students. Plagiarism quiz Kane Thomas, S. (2000). The oxford essential guide to writing. Zemach, D. E., & Rumisek, L. A. (2003). *Academic writing from paragraph to essay.* Macmillan.
		4.2 Basic Composition - Paragraph Writing -Email Writing -Essay Writing	1	Writing activities on various topics based on paragraphs paragraph, essay and email writing in local context.	1	
Total hours of thematic teaching-learning			8	Total hours of practical activities	8	

Semester I

Course Code: CFC412
Course Title: Computer Fundamentals
Nature of the Course: Theory and Practical
Level: Bachelor

Credit Hours: 1.5 [Theory: 0.5; Practical: 1.0]
Teaching Hours: 24

Course Description

This course covers the basic concepts of computer including introduction, hardware, software, networks, and social media.

Course Objectives

This course aims to introduce students to the basics of computer and its use and application in real world situation. Students are expected to learn to use the MS Office for word processing, spreadsheet, graphic presentation and Internet. Laboratory work is mandatory in this course.

Theory				Practical		References
Unit	Macro	Micro	Lecture Hour	Title	Lecture Hour	
I	Introduction to Computer	Introductions, Parts, Characteristics, Capabilities & Limitation, Classification, Generation, History of Computer in Nepal	2	Identification of Hardware and other peripheral devices, Proper connection of Devices, Knowledge about electrical power, Basic Computer Organization	3	Alexis Leon, Mathews Leon, *Fundamentals of Information Technology*, Leon TechWorld Albarran, Alan B. &Goff,David H.(2003): Understanding the Web, 1st Indian Reprint, Delhi:Surjeet Publication Pradeep K. Sinha, Priti Sinha,
II	Hardware Components of Computer System	CPU and its component, Memory and its types, I/O devices, Storage Devices	2			
III	Computer Software	Introduction to Computer Software, Classification of Software, Operating System, and Its Functions, Proprietary and Open-Source Software	2	Word Processing Software Creating, typing (English/Nepali/Unicode) Editing, Formatting, Settings, Saving the file in respective folder with password, Printing documents	5	
				Spreadsheet Software Creating, Format Cells, Using Formulae,	4	

				Saving the file in respective folder with password, Printing Spreadsheet		*Fundamental of computer, 4th edition, BPB* Publication Peter Norton's, Introduction *to Computers*, Tata McGraw-Hill
				Presentation Software Creating, Layout management, Designing, Slide transition, animation, Slide show	2	
IV	Computer Networks and social media	Network and its communication media, Types of Networks, Protocol, social media: Facebook, Twitter, LinkedIn	2	Identification of Network Cable, IP address, simple troubleshooting on Network related issues	2	
Total hours of thematic teaching-learning			8	Total hours of practical activities	16	

SemesterII

Course Code: CFC420
Course Title: Intermediate English
Nature of the Course: Theory and Practical
Level: Bachelor

Credit Hours: 1.5 [Theory: 0.5; Practical: 1.0]
Teaching Hours: 24

*Course Description:*This course enables students to enhance and acquire English language skills, such as, listening, reading, writing and speaking. In addition, it is designed to give students the opportunity to acquire vocabulary and grammar knowledge and practice them.

Objectives of the Course
By the end of this course, students will be able to:

a) Demonstrate effective listening skills by understanding listening process and overcoming barriers to effective listening.
b) Demonstrate writing competencies by producing positive emails, letters, and memos.
c) Read articles and reports critically and deliver short speech on various topics and enhance communicative grammar and vocabulary.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Fundamental language skills Introductions & Greetings	1.1. Introduction to key language skills; Listening, reading, writing, and speaking 1.3 Introductions and	1	1.2. Speaking: Introduce yourself, exchange your personal your information, remember your childhood /Grammar focus: past tense; used to for habitual actions 1.4. Pronunciation: reduced form of *used to*/Listening: listening to people talk about their past/Word power: complete the word map exercise.	2	Interchange, Fourth Edition, Student Book 2, Unit 1, p2-7 Richards, Jack C. et al. (2015). Interchange. 4th edition. Delhi: Cambridge

		greetings 1.5. Grammar: past tense pronunciation; vocabulary		1.6. **Writing:** Write a phragraph about your past. **Reading:** Read the article entitle Drew Barrymore, Actor, producer, director and complete exercise. **Activity:** Complete all pair and group works		University Press.
II	Exploring Transportation and city services	2.1. Describe transportation, transportation problems in your community and city	1	2.2. **Speaking:** Talking about transportation services and problems in your community; evaluating city services, asking and giving information. **Grammar:** Focus on use of quantity with count and noncount nouns; too many, too much, fewer, less, more, not enough, indirect questions from with Wh-questions **2.3. Pronunciation:** Syllable stress. **Listening:** listening to a description of a transportation/**Word power:** compound nouns/ 2.4. **Writing:** Write an online post about city service regarding how to attract tourists to your city? **Reading:** Read the article entitled New Ways of Getting Around and complete all exercises. **Activity- Complete all pair and group work**	2	Interchange, Fourth Edition, Student Book 2, Unit 2, p8-13 Richards, Jack C. et al. (2015). Interchange. 4th edition. Delhi: Cambridge University Press.
III	Going Places Travel; vacations; plans	3.1. Focus on travel plans, vacation advice 3.3. Highlight grammar. modals, writing about travel suggestions	1	3.2. **Speaking:** describing vacation plans; giving travel advice; planning a vacation/**Grammar:** future with be going to and will; modals for necessity and suggestion: must, need to, (don't) have to, ought to, -'better, should (not), **Word power:**travel planning, 3.4. **Pronunciation/listening:** linked sounds with /w/ and /y/listening to people talk about travel advice 3.5. **Writing:** write a travel letter giving suggestions. **Reading:** Read the article "Volunteer Travel-A vacation with a difference and complete excise. **Activity:** Complete all pair and group works.	2	Interchange, Fourth Edition, Student Book 2, Unit 5, p30-35 Richards, Jack C. et al. (2015). Interchange. 4th edition. Delhi: Cambridge University Press.
IV	Technology instructions	4.1. Understand and explain technology and learn infinitives and gerunds, stress 4..3. writing an essay asking for specific favors 4.5. Reading changes in	1	4.2. **Speaking:** Describing technology; giving instruction; giving suggestions, **Grammar:** infinitive gerunds for uses and purpose; imperatives and infinitives for giving suggestions 4.4. **Pronunciation/listening:** syllable stress, listening to people talk about technology use and misuse; **Word power:** the world of computers, 4.6. **Writing/reading:** Write an email and essay on use of digital	2	Interchange, Fourth Edition, Student Book 2, Unit 7, p44-49 Richards, Jack C. et al. (2015). Interchange. 4th edition. Delhi: Cambridge University Press.

		technology		skills. **Reading:** Read the article "Modern-Day Treasure Hunters" and complete excise. **Activity:** complete all pair and group works.		
V	**Talking about life in the past, present, future, and learning career skills**	5.1. Describe and compare life though the historical changes and consequences 5.3. Focus on abilities and skills for jobs, personality	1	**5.2. Speaking:** talk about changes, compare time periods, describe possible consequences, describe abilities and skills about job preferences, and describe personality traits. **Grammar:** Time contrast, conditional sentences, gerunds, clauses with because **Word power**: consequences/personality traits **5.4. Pronunciation/listening:** intonation, unreleased and released /t/ /d/ listening to people talk about changes, and their job preferences **5.5. Writing:** Write a description of a person and a cover letter for job application. **Reading:** Read the article "Find the Job That's Right for You! And complete all excise. **Activity:** Complete all excises.	2	Interchange, Fourth Edition, Student Book 2, Unit 9, & 10, p58-69 Richards, Jack C. et al. (2015). Interchange. 4th edition. Delhi: Cambridge University Press.
VI	**Watching movies and reading books**	6.1. Describing entertainment, movies, and reading books; giving reactions and opinions	1	**6.2. Speaking:** Describing movies and books, talking about actors, and actress, asking for and giving reactions and opinions. **Grammar:** participles as adjectives; relative pronouns, for people and things. 6.3. **Pronunciation/listening:** emphatic stress/listening for opinion. listening to people talk about movie and book review. **Word power:** Opinions, 6.4. **writing:** writing a movie and book review. **Reading:** Read the article "Special Effects" and complete excise given. **Activity:** Complete all pair and group works.	2	Interchange, Fourth Edition, Student Book 2, Unit 13, p86-91 Richards, Jack C. et al. (2015). Interchange. 4th edition. Delhi: Cambridge University Press.
VII	**Making requests, excuses, and invitations**	7.1. Making polite request, how to report what people said, and how to make invitations and excuses	1	**7.2. Speaking:** Making requests, invitations and excuses, **Grammar:** reported speech: request and statements, 7.3. **Pronunciation:** reduction of *had and would*; **Word power:** verb and noun pairs, **listening:** listen to people making requests, excuses and invitations. 7.4. **Writing:** write a report describing what your instructor and friends said about improving your English. **Reading:** Read the article "The Truth About Lying" and complete excise.	2	Interchange, Fourth Edition, Student Book 2, Unit 16, p106-111 Richards, Jack C. et al. (2015). Interchange. 4th edition. Delhi: Cambridge University Press.

		technology		skills. Reading: Read the article "Modern-Day Treasure Hunters" and complete excise. Activity: complete all pair and group works.		
V	Talking about life in the past, present, future, and learning career skills	5.1. Describe and compare life though the historical changes and consequences 5.3. Focus on abilities and skills for jobs, personality	1	5.2. Speaking: talk about changes, compare time periods, describe possible consequences, describe abilities and skills about job preferences, and describe personality traits. Grammar: Time contrast, conditional sentences, gerunds, clauses with because Word power: consequences/personality traits 5.4. Pronunciation/listening: intonation, unreleased and released /t/ /d/ listening to people talk about changes, and their job preferences 5.5. Writing: Write a description of a person and a cover letter for job application. Reading: Read the article "Find the Job That's Right for You! And complete all excise. Activity: Complete all excises.	2	Interchange, Fourth Edition, Student Book 2, Unit 9, & 10, p58-69 Richards, Jack C. et al. (2015). Interchange. 4th edition. Delhi: Cambridge University Press.
VI	Watching movies and reading books	6.1. Describing entertainment, movies, and reading books; giving reactions and opinions	1	6.2. Speaking: Describing movies and books, talking about actors, and actress, asking for and giving reactions and opinions. Grammar: participles as adjectives; relative pronouns, for people and things. 6.3. Pronunciation/listening: emphatic stress/listening for opinion. listening to people talk about movie and book review. Word power: Opinions, 6.4. writing: writing a movie and book review. Reading: Read the article "Special Effects" and complete excise given. Activity: Complete all pair and group works.	2	Interchange, Fourth Edition, Student Book 2, Unit 13, p86-91 Richards, Jack C. et al. (2015). Interchange. 4th edition. Delhi: Cambridge University Press.
VII	Making requests, excuses, and invitations	7.1. Making polite request, how to report what people said, and how to make invitations and excuses	1	7.2. Speaking: Making requests, invitations and excuses, Grammar: reported speech: request and statements, 7.3. Pronunciation: reduction of *had and would*; Word power: verb and noun pairs, listening: listen to people making requests, excuses and invitations. 7.4. Writing: write a report describing what your instructor and friends said about improving your English. Reading: Read the article "The Truth About Lying" and complete excise.	2	Interchange, Fourth Edition, Student Book 2, Unit 16, p106-111 Richards, Jack C. et al. (2015). Interchange. 4th edition. Delhi: Cambridge University Press.

				Activity: Complete all pair and group works.		
VIII	Outcomes of learning intermediate English	8.1. Outcomes of speaking and listening skills: ➢ Understanding of speaking and listing skills 8.3. Outcomes of writing and reading skills: ➢ Awareness of critical reading guidelines and three -step writing process. 8.5. Outcomes of grammar: ➢ Clear conceptual understanding of communicative English and grammar ➢ Improved vocabulary and pronunciation	I	8.2. Ability to speak fluentlyabout oneself, community, technology, historical changes, career, and any other topics and listen effectively. 8.4. Ability to read paragraph, articles, and books critically and write clearly using scientific writing structure while writing letter, essay, emails, description, and reviews. 8.5. Ability to use tense, gerunds, infinitive, prepositions properly, and adequate word power and correct pronunciation.	2	Interchange, Fourth Edition, Student Book 2 Richards, Jack C. et al. (2015). Interchange. 4th edition. Delhi: Cambridge University Press.
Total hours of thematic teaching-learning			8	**Total hours of practical activities**	16	

				Activity: Complete all pair and group works.		
VIII	Outcomes of learning intermediate English	8.1. Outcomes of speaking and listening skills: ➢ Understanding of speaking and listing skills 8.3. Outcomes of writing and reading skills: ➢ Awareness of critical reading guidelines and three -step writing process. 8.5. Outcomes of grammar: ➢ Clear conceptual understanding of communicative English and grammar ➢ Improved vocabulary and pronunciation	I	8.2. Ability to speak fluentlyabout oneself, community, technology, historical changes, career, and any other topics and listen effectively. 8.4. Ability to read paragraph, articles, and books critically and write clearly using scientific writing structure while writing letter, essay, emails, description, and reviews. 8.5. Ability to use tense, gerunds, infinitive, prepositions properly, and adequate word power and correct pronunciation.	2	Interchange, Fourth Edition, Student Book 2 Richards, Jack C. et al. (2015). Interchange. 4th edition. Delhi: Cambridge University Press.
Total hours of thematic teaching-learning			8	Total hours of practical activities	16	

Pedagogy: Communicative Approach

Instructor is to use the communicative approach to lead students into real communication task. When students will involve in real communication, their natural strategies for language acquisition will be used, allowing them to lean to sue the language. Students will take part in role-plays, debates and class discussion, pair work, problem solving interaction. Let student go through materials and take part in communication.

Semester II

Course Code: CFC421
Course Title: Computer Applications
Nature of the Course: Theory and Practical
Level: Bachelor

Credit Hours: 1.5 [Theory: 0.5; Practical: 1.0]
Teaching Hours: 24

Course Description

This course covers the basic concepts of database, internet, and various contemporary technologies in the present informative world.

Course Objectives

After the completion of this course students will be able to learn about

- Basic concept about database and its implementation
- Internet and its applications in various sector
- Contemporary technologies and security challenges in computer technologies

Theory				Practical		References
Unit	Macro	Micro	Lecture Hour	Title	Lecture Hour	
I	Data Base Management System	Data vs Information; Introduction to database and database management system; Flat file System and DBMS; Advantages of Database Systems; Relational Database Model; Database Administrator	2	Creating data base, Tables and Relationships, Query, Form, Report	4	Alexis Leon, Mathews Leon, *Fundamentals of Information Technology*, Leon TechWorld William Stallings, Cryptography and Network Security: Principles and Practice, 5/E, ISBN-10: 0136097049, Prentice Hall, India Limited Rolf De, Richard A. knippers,
II	Introduction of Internet and Web	Introduction to Internet and its applications; Client-Server Model of Internet; IP Address, Domain Naming System; Internet Protocols: TCP/IP, HTTP, POP, FTP, SMTP; WWW; Browsers; URL; Search Engine	2	E-mail and Settings; Online form and cloud storage (Google Forms, Google Drive and Sharing files and folders, Google Docs, Google Sheets, Google Slides, Drop box) Any Desk Tool	4	

III	Contemporary Technologies	Multimedia; E-Commerce; E-Learning; E-Governance; E-Banking; Mobile Computing; Cloud Computing; GIS; AI	2	**E-Learning Tools:** Video conferencing tool (Zoom, Google Meet, MS-Teams etc) application installation and practicing **E-Commerce:** Transaction on online payment system (Daraz Online, ebay, muncha.com etc) **E-Banking:** Mobile banking/Internet Banking techniques **E-Governance:** Online Government Services through web apps and url, Nagarik app **GIS:** Basics of ArcGIS ; QGIS ; Map reading ,Location finding and etc	8	Yuxian sun, *Principles of geographic information systems: An introductory textbook,* international institute for Geo-information science and Earth observation, the Netherlands Backus, Michiel, *e-Governance in Developing Countries,* IICD Research Brief, No. 1, March 2001
IV	Computer Security		2			
Total hours of thematic teaching-learning			8	Total hours of practical activities	16	

Semester III

Credit Hours: 1.5 [Theory: 0.5; Practical: 1.0]
Teaching Hours: 24

Course Code: CFC430
Course Title: Advance English
Nature of the Course: Theory and Practical
Level: Bachelor

Course Description

This course is designed to help students to develop their English language skills, grammar, reading, writing, listening, pronunciation, and oral communication in intercultural contexts, academic, professional, and at work.

Objectives of the Course

By the end of this course, students will be able to:

a) Demonstrate oral communication skills relating to describing personalities, career development, events, cultural practices, identifying problems, history, jobs, opinions, and arguments as well as constructive listening abilities.
b) Read various online and offline texts critically and write evidence-based essays and reports, letters, CV, Resume, and correspondences.
c) Use tense, preposition, adverbs, and relative clause, and increase word power for effective speaking and writing.

Course Contents

Unit	Macro Contents	Micro Contents			TH	Reference
		Theoretical Elements of learning	TH	Practical elements of learning		
I	The media news stories; exceptional events	1.1. Reading media news; stories, exceptional events. 1.2. Writing news stories using an outline of news writing process; pre-writing, writing and post writing.	2	1.1. **Speaking:** Deliver a speech describing past events of your life. **Grammar:** Past continuous VS. simple past; past perfect 1.4. **Pronunciation/listening:** Intonation in complex sentences, listening to news podcasts; listening to the narrative about past events/**Word power:** Events. 1.5. **Writing:** write a news story. **Reading:** Read the article "The Changing world of blogging and complete excise. **Activity:** Complete all pair and group works.	3	Student Book 3, Unit 4, p22-27 Richards, Jack C. et al. (2015). Interchange. 4th edition. Delhi: Cambridge University Press.
II	Talking about the environment; world problems; current issues	2.1. Identifying and describing problems; coming up with solutions 2.3. Identifying environmental problems in Nepal and Karnali	1	2.2. **Speaking:** Organize speech competition on Karnali environmental issues. **Grammar:** Passive in the present continuous and present perfect; proportions of clause; infinitive clause and phrases. 2.4. **Pronunciation/listening:** Reduction of auxiliary verbs, listening to environmental problems and solutions; **Word power:** world problems 2.5. **Writing:** Write a blog about environmental issues on a community website. **Reading:** Read the article "Saving a Coral Reef" and complete excise. **Activity:** Complete all pair and group works.	3	Interchange, Fourth Edition, Student Book 3, Unit 7, p44-49 Richards, Jack C. et al. (2015). Interchange. 4th edition. Delhi: Cambridge University Press.
III	Qualities for success and business advertising	3.1. What are the qualities for successful career? 3.3. Ways of writing TV advertisement	I	3.2. **Speaking:** Prepare an oral presentation about your qualities using visual and an outline of effective presentation and deliver oral presentation on your qualities for success. **Grammar:** Describing purpose with infinitive clauses, giving reasons with because of, for, due to, and the reason 3.4. **Pronunciation/listening:** reduced words, listening to features and slogans/**Word power:** Qualities for success 3.5. **Writing:** Write reports on advertisement using three steps writing process. **Reading:** Read the article "The Wrong Stuff" and complete all excise. **Activity:** Complete all pair and group works.	2	Interchange, Fourth Edition, Student Book 3, Unit 12, p78-83 Richards, Jack C. et al. (2015). Interchange. 4th edition. Delhi: Cambridge University Press.
IV	Challenges and accomplishments	4.1. Identifying and describing challenges, frustrations, rewards 4.3. Describing key elements	1	4.2. **Speaking:** Talk about your main challenges and accomplishments. **Grammar:** Complex noun phrases containing gerunds; accomplishments with the past present perfect and simple past; goals with the future perfect and would like to have +past participle	2	Interchange, Fourth Edition, Student Book 3, Unit 16, p106-111 Richards, Jack C. et al.

		of writing job application, CV and resume		**4.4. Pronunciation/listening:** Stress and rhythm, listening to challenges, rewards, goals; **Word power:** antonyms / **4.5. Writing:** Write a job application with CV/Resume. **Reading:** Read the article "Young and Gifted" and complete excise. **Activity:** Complete all pair and group works.		(2015). Interchange. 4th edition. Delhi: Cambridge University Press.
V	Going global	5.1. What does globalization mean for us? 5.3. Writing a report	1	**5.2. Speaking:** Delivered a speech on the effects of globalization on your community and city. **Vocabulary:** what does globalization mean for us? **5.4. listening:** Listen to people talk about globalization/**Grammar:** continuous verb forms. **5.5. Writing:** Write a report on key issuesof globalization using an outline of effective report. **Reading:** Read the passage "A changing city" and complete all excises. **Activity:** Complete all excises.	2	Cutting Age-Advanced Students' Book, Module 1, P6 Cunningham, Sarah. (2016). Cutting Age-Advanced Students' Book, Longman www.ongman.com
VI	21st century lifestyle	6.1. Balance between work and play in the 21st century lifestyle.	1	**Speaking:** Talk about balance between your work and play. **Grammar:** future forms/**Listening:** listening to YouTube on life in 21st century **Writing:** Write analytical reporton Nepalese life in 21st century. **Activity:** Complete all excises.	2	Students' Book, Module 9, P86 Cunningham, Sarah. (2016). Cutting Age-Advanced Students' Book, Longman www.ongman.com
VII	Learning Outcomes	7.1. Outcomes of Speaking 7.3. Outcomes of reading and writing 7.5. Outcomes of listening and grammar	I	7.2. Speak English proficiently and deliver effective presentation. 7.4. Improved reading and writing skills to deal with market issues and projects. 7.6. Constructive listening and improved grammatical skills	2	
Total hours of thematic teaching-learning			8		16	

Semester III

Credit Hours: 1.5 [Theory: 0.5; Practical: 1.0]
Teaching Hours: 24

Course Code: CFC431
Course Title: Glorified History and Culture of Nepal
Nature of the Course: Theory and Practical
Level: Bachelor

Course Description: This course is crafted on first level learning of the glorified history and culture of Nepal. The key contents of the study include a historical overview, great people, events, and cultural sets of the country.

Course Objectives: The general objective of this course is to empower the learners with a basic understanding of the glorified history and culture of Nepal. More specifically, this course aims to –

a. impart among the learners a basic understanding of the ancient, medieval, and modern history of Nepal, and
b. build an understanding of the glorified cultural aspects of Nepal.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Leaching	LH	Practical Elements of Learning	LH	
I	Historical Overview of Nepal	1.1. Nepal in the glory of history: Origin of the country; symbolic evidence on naming the country as 'Nepal'; environment, state, and society in the Central Himalayas to 1743; unification and Sanskritization, 1743-1885; ruling under Ranas 1885-1951; Quest for development under Monarchy in ascendance, 1951-1991; changes in lifestyles, values, identities, 1951-1991; democracy, insurrection, and federalism, 1991 onwards.	2:30	1.2. Work in collaborative groups to develop a historical profile of the country covering a different span of time and historical events taking place in Nepal; also establish a few cultural sets evolved along such developments; publish the outcomes of the collaborative work in the monthly bulletin and social media of the institution.	4:00	1. Whelpton, J., (2018). *History of Nepal.* London: Cambridge University Press.
		1.3. Evolution of ruling and political systems and geographical coverage in ancient, medieval, and modern era.	1:00	1.4. Develop a time-horizon map of the ruling of different dynasties in Nepal and the key cultural and historical changes taking place.	2.00	

II	Great Philosophers People of Nepal	2.1. Basic understanding of the philosophical thoughts initiated by the great philosophical thinkers of Nepal including Astavakra, Kapil Muni, Ne Muni, Manjushree, Chanakya, Jay Prithvi Bahadur Singh, B P Koirala, Pushpalal, Rup Chandra Bista, Yaggyabalkya, Gaargi, Gautam Buddha, Bharat Muni, Valmiki, Bhrigu, Gorakhnath, Balkrishna Sama, Narahari Nath, and Khaptad Baba.	2:00	2.2. Work in a collaborative group to develop a biography of top 20 great philosophers of Nepal without excluding the following ideals: Astavakra, Kapil Muni, Ne Muni, Manjushree, Chanakya, Jay Prithvi Bahadur Singh, B P Koirala, Bushpalal, Rup Chandra Bista, Yaggyabalkya, Gaargi, Gautam Buddha, Bharat Muni, Valmiki, Bhrigu, Gorakhnath, Balkrishna Sama, Narahari Nath, and Khaptad Baba, and publish it in the bulletin board in the classroom.	4:00	1. Sharma, A., & Gargai, R. P. (2012). Philosophers of Nepal. *Chapter 5: Philosophers of Nepal. pp. 62-131.* Kathmandu: Pragya Press.
III	Historical Events of Nepal	3.1. Very brief overview of the Top 10 historical events transforming Nepalese identity and glory of Nepal – 1. 1740s-1760s: Prithvinarayan Shah unifies Nepal 2. 2015: Nepal writes a historical constitution 3. 2015: Gorkhat Earthquake breaks out 4. 2001: The royal massacre 5. 1996-2006: Nepalese civil war 6. 1960: King Mahendra ceases control 7. 1989-1990: India first time seals the border, attempts similar act in 2015 but Nepal foils it 8. 1846: Kot Parba – the first massacre of the Nepalese history 9. 1814-1816: Anglo-Nepal war 10. 1953: First conquer on Mt. Everest	2:30	3.2. Allow students to work in different groups and to design and publish 'Nepal – Country Profile' with a blend of historical changes, cultural evolution, and international relations and then disseminate it in a seminar.	2:30	1. Stiller, S. J. L. F. (2022). *The rise of the house of Gorkha: A study in the unification of Nepal 1768-1816.* Kathmandu: Educational Publishing House. 2. Whelpton, J., (2018). *History of Nepal.* London: Cambridge University Press. 3. Wright, D., (2013). *History of Nepal.* New Delhi: Rupa Publications. Open source: https://sushrey.wordpress.com/2015/10/31/10-major-events-in-nepalese-history/

IV	Cultural Sets of Nepal	4.1. Brief overview of cultural sets in Nepal from the national political, religious, geographic, and caste-ethnic perspectives.	1:00	4.2. Allow students to work in collaborative teams to explore and develop 'Cultural Monograph of Nepal' showing various cultural events in practices in different provinces and ask them to ma 4.3. ke a presentation of the significance of such events practices.	2:30	Open source exploration and learning: For example, https://mofa.gov.np/about-nepal/culture-society/ https://www.holidify.com/pages/culture-of-nepal-862.html https://en.wikipedia.org/wiki/Culture_of_Nepal
Total hours of thematic teaching-learning			9.00	Total hours of practical events	15.00	

Semester IV

Course Code: CFC440
Course Title: Organic Food, Health, and Happiness
Nature of the Course: Theory and Practical
Level: Bachelor

Credit Hours: 1.0 [Theory: 0.5; Practical: 0.5]
Teaching Hours: 16

Course Description: As a common foundation course at Mid-West University, this course comprises the basic understanding of organic food, health, and happiness with their significance for better human life.

Course Objectives: The general objective of this course is to empower the learners with a basic understanding of the meaning, processes, and significance of organic food, health, and happiness. More specifically, this course aims to –

c. impart among the learners a basic understanding of organic food,
d. orient them with an understanding of maintaining healthy habits, and
e. empower the learners with an understanding of happy life.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Leaching	Lecture Hour	Practical Elements of Learning	Lecture Hour	
I	Organic Farming and Food	1.5. Introduction to organic farming, pest control, and remedial of soil pollutants. 1.6. Concept of organic farming and gardening; skill practices in organic farming and gardening. 1.7. Social and environmental issues, challenges, and significance of organic farming and gardening.	4.00	1.8. Organize a community-level workshop to impart practical knowledge and skills on organic food production using indigenous knowledge.	4:00	1. Lichtfouse, E. (Ed). (2009). Organic farming, pest control, and remedial of soil pollutants. *Sustainable Agriculture Reviews, Vol. 1*. Dijon, France: Springer. 2. Miles, A., & Brown, M. (Eds). (2005). *Teaching organic farming and gardening: Resources for instructors*. UCSC Farm and Garden Apprenticeship. California: University of California.
II	Maintaining Better Health and Happiness	2.3. Setting goals, and relating them with habits for better health and life. 2.4. Stacking good habits for a better career, money, life, and relationships. 2.5. Setting a positive mindset: discovery, understanding, and changing a positive mindset.	4:00	2.6. Organize a workshop to be facilitated by a locally available spiritual speaker and positive change maker on imparting among the graduates with a positive mindset for life.	4:00	1. Scot, S. J. (2017). *Habit stacking: 127 small changes to your health, wealth, and happiness*. (2nd ed.). Oldtown Publishing LLC. 2. Sanderson, C. A. (2019). *The positive shift: Mastering mindset to improve health, happiness and longevity*. Texas: BenBell Books.
Total hours of thematic teaching-learning			8:00	Total hours of practical events	8:00	

Semester IV

Course Code: CFC441
Course Title: Disaster and Humanitarian Response
Nature of the Course: Theory and Practical
Level: Bachelor

Credit Hours: 1.0 [Theory: 0.5; Practical: 0.5]
Teaching Hours: 16

Course Description: This course comprises of learning of basic concepts and practical insights on disaster and humanitarian response.

Course Objectives: The general objective of this course is to empower the learners with basic understanding of basic concepts of disaster, disaster preparedness and humanitarian response. Specifically, this course aims to –

f. impart among the learners with basic concepts of disaster and its classifications,
g. transform pragmatic skill competence and attitude on disaster preparedness, and
h. inculcate among the learners' effective professional behavior on humanitarian response.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Leaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction to disaster and hazard	1.6. Meaning, nature, definitions of disaster; comparison of disasters and hazards; classifications of disasters and hazards.	1.0	1.7. Initiate open-source learning activities among the students asking them to explore the definitions of disaster by Oxford Dictionary, UN, IFRC, and other international and national agencies.	0.5	The International Federation of Red Cross and Red Crescent Societies (IFRC). What is disaster? Available at: What is a disaster? | IFRC. National Institute of Disaster Management, Ministry of Home Affairs, Government of India. Understanding disasters. Available at: Disaster_about.pdf (nidm.gov.in).
		1.8. Concept of humanitarian or emergency response; different terminologies in in emergency response [disaster risk readiness/preparedness, disaster risk response, emergency response, etc.]	1.0	1.9. Visit a nearby disaster prone location observation asking the students work in groups and outline probable disasters that may take place in this location.	2.0	United Nations. (2008). Disaster preparedness for effective response: Guidance and indicator package for implementing priority five of the Hyogo Framework. Hyogo Framework for Action 2005-2015: Building the resilience of nations and communities to disasters. (unisdr.org).
		1.10. National institutional and legislative frameworks on DRR in Nepal [provisions for community levels, district level, provincial level, national level institutions working on	1.0	1.11. Invite a member of District Disaster Response Committee (DDRC) or any professional working in humanitarian response for sharing experiences on	1.0	Hyer, K., & Brown, L. M. (2012). Chapter 14: Disaster preparedness, response, and recovery. ResearchGate. January 2012. url: https://www.researchgate.net/publication/259821922 Sutton, J., & Tierney, K. (2006). Disaster

		DRR; international agencies working in the field of DRR in Nepal].		working in the specialized field of disaster risk or humanitarian response.		preparedness: Concepts, guidance, and research. Natural Hazards Center Institute of Behavioral Science, University of Colorado Boulder, CO. http://www.colorado.edu/hazards.
II	Approaches, strategies, and operational coordination on DRR	2.1. Holistic approaches to DRR preparedness.	1.0	2.2. Facilitate the students work in groups to set out the holistic approaches to DRR preparedness for the site visited during the practical work of activity 1.4 in Unit I.	1.0	United Nations. (2008). Disaster preparedness for effective response: Guidance and indicator package for implementing priority five of the Hyogo Framework. Hyogo Framework for Action 2005-2015: Building the resilience of nations and communities to disasters. (unisdr.org).
		2.3. General strategies on DRR and humanitarian response.	0.5	2.4. Help the students establish one or two strategies to be adapted to address the likely DRR situations explored during activity 1.4 of Unit I.	0.5	
		2.5. Coordination at the local, national, regional, and international level.	0.5	2.6. Perform class discussions on coordinated roles and responsibilities of various institutions on responding to likely DRR situations as explored during activity 1.4 of Unit I.	1.0	
III	DRR preparedness and readiness for response	3.1. Introduction to key components of DRR preparedness planning a. Contingency planning b. Capacity analysis and capacity-building c. Hazard monitoring, forecasting and early warning d. Information management and communication	1.5	3.2. Perform a round-table discussion among the students key components of DRR planning taking reference of the site visited during activity 1.4 in Unit I and ask them to prepare practical working notes on: a. Contingency planning b. Capacity analysis and capacity-building c. Hazard monitoring, forecasting and early warning d. Information management and communication	1.0	United Nations. (2008). Chapter 3: Disaster preparedness for effective response: Guidance and indicator package for implementing priority five of the Hyogo Framework. Hyogo Framework for Action 2005-2015: Building the resilience of nations and communities to disasters. (unisdr.org).

		3.3. Readiness for response a. Emergency services and stand-by arrangements b. Incorporating early recovery into preparedness planning c. Resource allocation and funding	1.0	3.4. Perform an on-campus DRR response drill with reference to activity 1.4 in Unit I by including: a. Emergency services and stand-by arrangements b. Incorporating early recovery into preparedness planning c. Resource allocation and funding	1.0	United Nations. (2008). Chapter 4: Disaster preparedness for effective response: Guidance and indicator package for implementing priority five of the Hyogo Framework. Hyogo Framework for Action 2005-2015: Building the resilience of nations and communities to disasters. (unisdr.org).
IV	Outcomes of effective DRR interventions	4.1. Outcomes: shared happiness and confidence, felt safety of living, quality of life, increased social trust towards social institutions.	0.5	--		
Total hours of thematic teaching-learning			8.0	Total hours of practical events	8.0	

Semester V

Course Code: CFC450
Course Title: Basic Research Writing, Ethics, Publications and Seminar in Social Science
Nature of the Course: Theory and Practical
Level: Bachelor

Credit Hours: 1.0 [Theory: 0.5; Practical: 0.5]
Teaching Hours: 16

Course Description: This course has been crafted on four elementary aspects of research in academia including basic research writing, ethics in academia and research, publications, and seminar related academic initiatives. The course contents have been designed with a balanced orientation of conceptual and practical aspects of each element of teaching-learning.

Course Objectives: In general, this course aims to empower the learners with basic understanding of the basic concepts and applications of elementary research writing, ethical compliances, accomplishing academic publications and accomplishing seminar related academic discourses. More specifically, it aims to –

i. impart among the learners with basic concepts of research writing, ethical compliances in academia and research, producing papers for academic publications, and performing seminar related activities, and
j. transform the practical skills among the learners on basic research writing, applying ethical codes of conduct in research, producing academic publications, and organizing different seminar related events in academia.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Leaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction to research and research writing	*1.1. What is research:* Meaning, significance, broad classifications [pure and applied research], and applications of research in different sectors.	1.0	1.2. Perform a group discussion on applications of research in – a. Social science and education b. Public administration and business c. Engineering, and science and technology d. Medicine and nursing e. National security, law, and international relations	1.0	Kothari, C. R. (2010). *Research methodology: Methods and techniques.* (2nd ed.). New Delhi: New Age International Publishers.

		1.3. *Research proposal:* Meaning, significance, types, and key elements of research proposal.	1.0	1.4. Provide a few copies of research proposals related to selected areas of specialization and ask the students to segregate the technical and financial components of the selected proposals.	1.0	Kabir, S. M. S. (2018). Research proposal: Chapter 11 – Research proposal. ResearchGate. Available at: ResearchGate. Gillani, A. H. (2022). How to write a research proposal. Academia. Available at: (48) How to Write Research Proposal: 13 Elements of Research Proposal | Dr. Awais H. Gillani - Academia.edu. Mid-West University. (2022). Academic writing guidelines. Birendranagar: Author.
		1.5. *Research report*: Writing an academic research report [Meaning, nature, significance and key components - prefatory part, main body, and supplementary part].	1.0	1.6. Using the given reference copies of research reports, prepare an outline of various parts and sections of an academic research report. Organize it as follows: a. Prefatory part b. Main body c. Supplementary part	1.5	Baguma, S. D., Anandajayasekeram, P., & Puskur, R. (2009). Writing convincing research proposals and effective scientific reports: A learning module. International Livestock Research Institute. Meyers, A. (2014). Longman academic writing series 5: Essays to research papers. Pearson Education. ISBN-13: 978-0-13-291274-7.
		1.7. *Research report:* Writing a professional research report [Meaning, nature, significance and key components - prefatory part, main body, and supplementary part].	1.0	1.8. Analyzing the sample copies of professional research reports, establish a comparative display of various parts and elements/sections under each part. a. Prefatory part b. Main body c. Supplementary part	1.0	

II	Compliance of ethics in research	2.1. Socio-ethical compliances in research [treatment of the researchers, treatment of the research participants, treatment of the research client, wiser citation and referencing of the sources of review].	1.0	2.2. Work in groups to outline 3-5 functions to initiate ethical practices in respect with the treatment of – a. Research team members b. research participants, and c. research clients	1.0	Mid-West University. (2022). Academic writing guidelines. Birendranagar: Author. Zikmund, Carr, & Griffin. (2011). Business research method. (8th ed.). Iltis, A. S. (Ed). (2006). *Research ethics.* New York: Routledge Taylor and Francis Group.e-book ISBN 0-203-79927-5.
III	Publications and seminar	3.1. *Article writing*: Meaning, nature, significance, key components of an article.	1.5	3.2. Organize an orientation workshop on writing a short article including abstract, author introduction, key words, introduction, materials and methods, results, and discussion (IMRD), and references.	1.0	Saleh, N. (2014). *The complete guide to article writing: How to write successful articles for online and print markets.*
		3.3. Seminar writing: Meaning, nature and significance of seminar paper; writing a seminar paper, conference paper, workshop proceedings/notes, and making presentation.	1.5	3.4. Organize an instructional workshop on writing a review paper based on (i) book review, (ii) report review, and (iii) article review following IMRD pattern; making a presentation]	1.5	
Total hours of thematic teaching-learning			**8.0**	**Total hours of practical events**	**8.0**	

Semester V

Course Code: CFC451
Course Title: Basic Statistics and Bioinformatics
Nature of the Course: Theory and Practical
Level: Bachelor

Credit Hours: 1.5 [Theory: 0.5; Practical: 1.0]
Teaching Hours: 24

1. **Course Description:**

This course provides the basic knowledge and skill in statistics and application of statistics in data analysis as well as fundamental knowledge of bioinformatics, its importance, and applications for analyzing biological data using computer.

Objectives of the Course:

- To understand the computing solution of biological problem, and biological process.
- To show students the relevance of statistics
- To Familiarize the students with software used for the data analysis.
- To provide guidance to students for using software

Basic Statistics

Unit	Macro Content	Micro Content				References
		Theoretical Concept	Lecture Hour	Practical Application	Lecture Hour	
I	1. Introduction to Statistics and Data collection	1.1 Origin and history, meaning, definition, uses, Functions, and limitations of Statistics, important terminologies (population, sample, parameter, statistic, census) 1.2 Data classification (data types based on sources and nature), measurement and scaling (Nominal, ordinal, interval and ratio)	2	1.3 Introduction to Microsoft Excel 1.4 Collection of data related to profile of classmates and classify them	2	Statistics for who hate statistics Using excel 2016(by-Neil-J.-Salkind), *Sage publication* Understandable Statistics by Charles Henry Brase Corrinne Pellillo Brase, *Houghton Company, Boston, New York*
II	2. Presentation of Data	2.1 Frequency distribution, bar diagram, histogram, pie-chart, Frequency curve	1	2.2 Data entry and formation of frequency table and charts using MS Excel	2	Outline of Business Statistics by Leonard Kazmier, *McGraw-Hill*

III	3. Summary Measures	3.1 Central Tendency (mean, median, mode, quartiles) 3.2 Measure of Variation (Range, quartile deviation, standard deviation, coefficient of variation 3.3 Five-point summary, Box and whisker diagram	2	3.4 Using MS EXCEL to calculate summary measures and measures of variation, normality check	3	*companies*
IV	4. Relationship between variables	4.1 Definition and differences between correlations and regression	2	4.2 Using MS EXCEL to calculate correlation and regression from the data collected previously and interpretation of the results	2	
Total hours of thematic teaching-learning			7	Total hours of practical activities	9	

Bioinformatics

Theory				Practical		References
Unit	Macro	Micro	Lecture Hour	Practical Title	Practical Hour	
I	Introduction	Concept, History, Scope, Importance, goal, and Future	1	Explore and observe various application, implementation and use of Interdisciplinary subject in the real-world practice in respective laboratory	2	Arthur M.Lesk, *Introduction to Bio-informatics*, Oxford University Press. Agostino,M.,*Practical Bioinformatics*, 1st ed; Garland Science,2013 Pangeni, R.P., *Concept of Bioinformatics*,
II	Interdisciplinary areas of Bioinformatics	Molecular biology, Bio physics, Chemistry, Mathematics, Statistics, Computer	1			
III	Foundation of Bioinformatics	Biological Sequence:DNA, RNA, Protein analysis and its application; Central Dogma of bioinformatics:	2	Analysis of Central Dogma of life science: DNA, RNA and Protein	2	

		Sequence, Structure and Function; Genomic Organization				Published by Sukunda Pustak Bhawan, Bhotahity, Kathmandu, Nepal, 2007. Ignacimuthu,S.,*Basic Bioinformatics*, Narosa Publishing Hourse, New Delhi, Chennai, Mumbai, Kolkata, India, 2006.
IV	Technological requirement for Bioinformatics	Operating system, programming language, Computer graphics, database, and Internet	1	Installing any one operating system, required programming software and gain basic knowledge about computer graphics and internet	2	
V	Biological data warehouse	National Center for Biotechnology Information (NCBI), DNA Data Bank of Japan(DDBJ), European Molecular Biological Laboratory (EMBL), Protein Data Bank(PDB),Gen Bank	2	Analyze the biological data from various databank with respect to their application in various fields and extract appropriate result	2	
VI	Application of Bioinformatics	Crop Testing, Developing Agriculture Product, Drug Design, Plant and Animal genomic, Medical Science	1			
Total hours of thematic teaching-learning			*8*	**Total hour of practical activities**	16	

Course Code: ECO413 *Credit Hours:* 2.0 [Theory: 1.0; Practical: 1.0]

Course Title: Principles of Economics *Teaching Hours:* 32:00

Semester I

Course Description: This course comprises learning of basic concepts of resource use efficiency, sustainability and its evaluation for natural resource conservation skills development among the learners.

Course Objectives: The general objective of this course is to emphasize economic concepts such as resource scarcity, externalities, property rights, opportunity cost, sustainability, and valuation in their application to studies of natural resources and environmental amenities. Specifically, this course aims to- write all course objectives consistently – same pattern

a. Understand the economic justification for regulatory action in allocating, managing, and protecting the environment and natural resources,
b. evaluate natural resource and environmental policies using basic economic tools, and
c. apply economic principles to problems involving public and private natural resources and the environment.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				Reference
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction to Economics	1.1. Definition of Economics, Nature and Scope of Economics	1:00	1.2. *Case Study*: Analyze the impact of economics on daily life in rural areas	1:00	Mankiw, N. G. (2014). *Principles of Economics* (7th ed.). Cengage Learning.
		1.2. Basic Concepts: Goods, Utility, Value, Price, Capital, Wealth	1:00	1.3. *Survey*: Conduct a survey in a local market to classify goods into different categories (consumer goods, capital goods, etc.)	1:00	Case, K. E., & Fair, R. C. (2007). *Principles of Economics* (8th ed.). Pearson Education.

	Resources and Rural Economics	5.2. Role of Agriculture in the Economy, Rural Development, and Poverty	1:00	5.3. *Case Study*: Analyze a rural community's use of production factors to understand economic growth	1:00	Samuelson, P. A., & Nordhaus, W. D. (2010). *Economics* (19th ed.). McGraw-Hill.
VI	Economics of Agricultural Products	6.1. Demand and Supply of Agricultural Products	1:00	6.2. *Survey*: Conduct a survey to understand the factors affecting the demand and supply of specific agricultural products	1:00	Mandal, S. N. (2013). *Brief Introduction to Economics.* Department of Agriculture, Lalitpur, Nepal.
		6.3. Role of Government Policies in Agriculture		6.4. *Workshop*: Workshop on agricultural policies and their impact on local farming communities	1:00	Case, K. E., & Fair, R. C. (2007). *Principles of Economics* (8th ed.). Pearson Education.
VII	National Economic Indicators and Agriculture	7.1. National Income: Definition, Methods of Measurement	1:00	7.2. *Data Analysis*: Use real economic data to calculate and analyze national income and its agricultural component	1:00	Mankiw, N. G. (2014). *Principles of Economics* (7th ed.). Cengage Learning.
		7.3. Agriculture's Contribution to National Income	1:00			Mandal, S. N. (2013). *Brief Introduction to Economics.* Department of Agriculture, Lalitpur, Nepal.
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	16:00	

Course Code: ECO422

Credit Hours: 3.0 [Theory: 1.0; Practical: 2.0]

Course Title: Farm Resource Management

Teaching Hours: 32:00

Semester II

Course Description: This course introduces students to the principles and practices of farm management, emphasizing efficient use of farm resources, planning, record keeping, and decision-making under risk and uncertainty.

Course Objectives: The general objective of this course is to familiarize students with key concepts and tools of farm management. Specifically, the course aims to –

a. Introduce the theoretical and practical aspects of farm decision-making,
b. equip students with skills for efficient use of farm resources, planning, and budgeting, and
c. enable students to analyze risks, records, and profitability in farming systems.

Contents

Unit	Macro Level Contents	Micro Level Contents				Reference
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction to Farm Management	1.1 Overview of farm management concepts	1:00	1.2 *Group Work*: Discussion and concept clarification on farm management and its historical development	2:00	Kay, R. D., Edwards, W. M., & Duffy, P. A. (2016). *Farm management* (8th ed.). McGraw-Hill Education. Johl, S. S., & Kapoor, T. R. (2001). *Fundamentals of farm business management* (5th ed.). Kalyani Publishers.
		1.3 Historical development of farm management	1:00	1.4 *Group Work*: Timeline chart preparation on farm management evolution	2:00	
		1.5 Importance and relationship with other sciences	1:00	1.6 *Group Work*: Concept mapping activity showing relationship of farm management with other disciplines	2:00	

II	Farm Management Decisions	2.1 Strategic and operational decisions in farm management	1:00	2.2 *Role Play*: Decision-making scenario simulation in farm management	2:00	Heady, E. O., & Jensen, H. H. (1964). *Farm management economics.* Prentice Hall. Barnard, C. S., & Nix, J. S. (1994). *Farm planning and control* (2nd ed.). Cambridge University Press.
		2.3 Marketing and administrative decisions	1:00	2.4 *Field Visit*: Observation of market dynamics and interaction with farmer cooperatives	2:00	
		2.5 Farm management in different agricultural systems	1:00	2.6 *Case Study*: Comparative analysis of farm management practices in different agro-ecological regions	2:00	
III	Resource Use and Efficiency	3.1 Input-output relationship in farming systems	1:00	3.2 *Field Visit*: Collection of input-output data from a selected local farm	2:00	Dillon, J. L., & Hardaker, J. B. (1993). *Farm management research for small farmer development.* Food and Agriculture Organization (FAO). Beattie, B. R., & Taylor, C. R. (1985). *The economics of production.* Krieger Publishing.
		3.3 Profit maximization and cost-benefit analysis	1:00	3.4 *Group Work*: Cost-benefit analysis using collected farm data	2:00	
		3.5 Use of resources (land, labor, capital) in farm planning	1:00	3.6 *Field Activity*: Farm mapping and inventory of available resources	2:00	
IV	Farm Planning and Budgeting	4.1 Types of farm planning and budgeting	1:00	4.2 *Group Work*: Exercise on complete, partial, and enterprise budgeting	2:00	Panda, S. C. (2008). *Farm management and agricultural marketing.* Agrobios India. Makeham, J. P., & Malcolm, L. R. (1993). *The farming game: Agricultural management and marketing* (2nd ed.). Cambridge University Press.
		4.3 Steps in farm budgeting: complete, partial, enterprise	1:00	4.4 *Group Work*: Preparation of farm budget using hypothetical data	2:00	
		4.5 Preparation of farm budget and financial statements	1:00	4.6 *Group Work*: Preparation of income statement and cash flow statement	2:00	

V	Farm Record Keeping	5.1 Types of farm records and their significance	1:00	5.2 *Group Work*: Preparation of various farm records such as input log, output log, and inventory register	2:00	Dhondyal, S. P. (1988). *Farm management: An economic analysis*. Friends Publication. Oludimu, O. L., & Adebayo, K. (2000). *Introduction to agricultural management*. Spectrum Books.
		5.3 Balance sheet, income statement, and cash flow	1:00	5.4 *Group Work*: Calculation of balance sheet and financial performance evaluation	2:00	
VI	Risk and Uncertainty in Farming	6.1 Agricultural risks and uncertainties	1:00	6.2 *Case Study*: Risk assessment and analysis of a selected farm business	2:00	Hardaker, J. B., Huirne, R. B. M., Anderson, J. R., & Lien, G. (2004). *Coping with risk in agriculture* (2nd ed.). CABI Publishing. Harwood, J., Heifner, R., Coble, K., Perry, J., & Somwaru, A. (1999). *Managing risk in farming: Concepts, research, and analysis* (No. 774). U.S. Department of Agriculture,
		6.3 Risk management techniques in farm business	1:00	6.4 *Group Work*: Identification of risk management tools and strategy presentation	2:00	
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**32:00**	

Course Code: ECO432

Credit Hours: 2.0 [Theory: 1.0; Practical: 1.0]

Course Title: Natural Resource Economics

Teaching Hours: 32:00

Semester III

Course Description: This course comprises learning of basic concepts of resource use efficiency, sustainability, and its evaluation for natural resource conservation skills development among the learners.

Course Objectives: The general objective of this course is to emphasize economic concepts such as resource scarcity, externalities, property rights, opportunity cost, sustainability, and valuation in their application to studies of natural resources and environmental amenities. Specifically, this course aims to:

a. Understand the economic justification for regulatory action in allocating, managing, and protecting the environment and natural resources,
b. evaluate natural resource and environmental policies using basic economic tools, and
c. apply economic principles to problems involving public and private natural resources and the environment.

Course Contents:

Unit	Macro Level Contents	Micro Level Contents				Reference
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction to Natural and Environmental Resources	1.1. Concept, nature, meaning, and types of natural resources	1:00	1.2. *Visit:* Discuss and present different energy sources in the nearby community and classify according to local use priority	2:00	Humphreys, M. (2005). Natural resources, conflict, and conflict resolution: Uncovering the mechanisms. *Journal of Conflict Resolution, 49*(4), 508-537. Tietenberg, T., & Lewis, L. (2018). *Environmental and natural resource economics* (7th ed.). Routledge Publishers, New York, USA.
		1.3. Basic terminologies: Scarcity, Environmental equity and justice, Sustainable development, Tragedy of commons, Green economy, Carbon trading and pricing, Optimum resource allocation, Ecosystem services	2:00	1.4. *Group Discussion*: Develop a case study on a national-level resource use conflict	2:00	
II	Environmental Externalities	2.1. Market failure: Concept, causes, consequences, and remedies	1:00	2.2. *Guided discussion* : Major cases of market failure	2:00	Laffont, J. J. (1989). Externalities. *Allocation, information, and markets*, 112-116. Tietenberg, T., & Lewis, L. (2016). *Environmental and natural resource economics* (11th ed., pp. 22-37). Routledge and Taylor Francis Group
		2.3. Positive and negative externalities: Definitions, examples, management tools and strategies; Internalizing externalities; Measurement of externalities – environmental valuation	1:00	2.4. *Group work*: Present positive and negative externalities and their respective remedies	2:00	

						Publication.
III	Policies on Resource Optimization and Management	3.1. Protected areas and conservation policy (NPWC Act, Irrigation Act, Climate Change Policy of Nepal)	2:00	3.2. *Project work*: Develop a resource map of local communities using participatory tools	2:00	Retrieved from https://dnpwc.gov.np/
		3.3. Land use planning by local governments; International treaties: Kyoto Protocol and IPCC reports; Corporate Social Responsibility (CSR) in Nepal; Intellectual property rights and copyright process	4:00	3.4. *Presentation*: Property rights and related legislative processes	2:00	Retrieved from https://unece.org/air-pollution-ecosystems-and-biodiversity#:~:text=Ecosystems%20are%20impacted%20by%20air%20pollution%2C%20particularly%20sulphur,acidity%20with%20adverse%20effects%20on%20flora%20and%20fauna.
IV	Climate Change and Agriculture	4.1. Concept of climate change and its impacts on agriculture; Vulnerability, exposure, adaptive capacity; Mitigation and adaptation measures	2:00	4.2. *Group discussion* : Current burning issues related to climate change	2:00	Bhattacharya, A. (2019). Global climate change and its impact on agriculture. *Changing Climate and Resource Use Efficiency in Plants*, Academic Press: Cambridge, MA, USA, 1-50. Piao, S., Ciais, P., Huang, Y., Shen, Z., Peng, S., Li, J., Mall, T., & Fang, J. (2010). The impacts of climate change on water resources and agriculture in China. *Nature*, *467*(7311), 43-51.
V	Natural Resource Valuation	5.1. Resource valuation: Definitions, approaches, and methods; Optimum resource use: Concept and application; Environmental Kuznets Curve and Fishery Models (e.g., Gordon-Schaefer Model)	3:00	5.2. *Literature review* : Natural resource valuation methods	2:00	Shiferaw, B., Freeman, H. A., & Navrud, S. (2005). Valuation methods and approaches for assessing natural resource management impacts. In *Natural Resource Management in Agriculture: Methods for Assessing Economic and Environmental Impacts* (pp. 19-51). Wallingford UK: CABI Publishing. Tallis, H., & Polasky, S. (2009). Mapping and valuing ecosystem services as an approach for conservation and natural resource management. *Annals of the New York Academy of Sciences*, *1162*(1), 265-283.
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	16:00	

Course Code: ECO442

Credit Hours: 3 [Theory: 1; Practical: 2.0]

Course Title: Principles of Agri Entreprise Development Development

Teaching Hours: 48

Semester IV

Course Description: This course aims to foster a vibrant entrepreneurial ecosystem within the agricultural sector. It focuses on building entrepreneurship and agribusiness management skills that support sustainable agricultural development, economic growth, and rural prosperity.

Course Objectives: The general objective of this course is to provide students with the necessary knowledge, skills, and resources to establish and manage agricultural enterprises that support economic development and rural livelihoods. Specifically, the course aims to:

a. Develop entrepreneurship skills using technical and innovative knowledge, promoting agribusiness leadership through value addition and agri-processing,
b. evaluate and assess financial resources for business start-up and venture establishment, including market networking and linkages, and
c. analyze financial tools to address issues involving sustainable resource management and develop an enabling business environment.

Unit	Macro Level Contents	Micro Level Contents				Reference
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction to Entrepreneurship	1.1 Concept and definition, importance, process, prerequisites, and opportunities of entrepreneurship	2:00	1.2 *Group Discuss*: Present successful agribusiness cases from Nepal and abroad	4:00	Reddy, M.V.S. (2021). *Agribusiness Management and Entrepreneurship*. Brillion Publishing.
		1.3 Basic terminologies: firm, farm, industry, seller, entrepreneur	2:00	1.4 *Role-play*: qualities of a successful entrepreneur	3:00	

II	Business/Marketing Research & Design	2.1 Market research: concept, elements, importance, process; need assessment and gap analysis	2:00	2.2 *Case presentation*: Community problem with need assessment & gap analysis	4:00	Kothari, C.R. (2021). *Research Methodology* (4th ed.). New Era International Publication.
		2.3 Marketing research design: types of data, data collection methods (sampling), processing & analysis	2:00	2.4 *Group work*: Sub-sector agribusiness analysis.	3:00	
III	Entrepreneurship Structure & Business Environment	3.1 Structure and functional roles of entrepreneurship elements	2:00	3.2 *Group work*: Develop an action plan for a business idea	3:00	Hiremath, G.M., Chandargi, D.M. (n.d.). *Agriculture Graduates' Aptitude towards Entrepreneurship Development*. Satish Serial Publishing House.
		3.3 Business environment: micro and macro, barriers, risk, and challenges in startups	2:00	3.4 *Group Discuss*: Experience sharing session on business startup & professionalism	3:00	
IV	Financial & Marketing Intermediaries and Financial Evaluation	4.1 Definitions and roles of intermediaries in agribusiness	2:00	4.2 *Presentation*: Display report on Nepal's major agri-financial and marketing intermediaries	3:00	Gittinger, J. Price. (n.d.). *Economic Analysis of Agricultural Projects*. Johns Hopkins University Press.
		4.3 Financial evaluation: SWOT, PESTEL, NPV, IRR, ROI, B:C, BEP, return analysis	2:00	4.4 *Case Study*: SWOT analysis	3:00	
				4.5 *Case Study*: PESTEL analysis	3:00	
				4.6 *Class discuss*: Financial analysis using dummy and real data (discounted & compounded methods)	3:00	
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**32:00**	

Course Syllabus

Course Code: ECO452 Semester V

Course Title: Agriculture Marketing, Trade and Pricing Policy

Credit Hours: 3 [Theory: 1; Practical: 2]
Teaching Hours: 48

Course Description: This course provides students with an understanding of agricultural marketing systems, trade mechanisms, and pricing policies with particular emphasis on the Nepalese context. It explores the structure and function of agricultural markets, market information systems, cooperative involvement, marketing efficiency, and international trade. The course also introduces tools and techniques for analyzing agricultural value chains, demand forecasting, and government interventions in marketing.

Course Objectives: The general objective of this course is to provide students with foundational knowledge of agricultural marketing, trade, and pricing policy, focusing on practical applications in the Nepalese context. Specifically, this course aims to-

a. Understand core concepts of agricultural marketing, trade, and pricing,
b. explore the roles of cooperatives, policies, and institutions in market systems, and
c. assess the impact of national and international trade on Nepal's agriculture.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				Reference
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Agricultural Markets	1.1 Concept of agricultural market and marketing; types of markets, role of agriculture in the economy, key challenges in agricultural marketing	1:00			FAO. (2022). *Agricultural market development and food security.* Food and Agriculture Organization of the United Nations.
		1.2 Nature, features, and present situation of agricultural markets in Nepal; problems in marketing, market regulations, and reforms	1:00	1.3. *Micro-presentations*: Analyse challenges in Nepalese agricultural markets through stakeholder interviews.	1:00	Nepal Agriculture Marketing Development Corporation. (2020). *Agriculture market situation report in Nepal.* Kathmandu: NAMDC.
		1.4. Marketing system and channels: food crops, vegetables, fruits, MAPs, livestock & high-value crops; marketing strategies for diverse commodities	1:00	1.5. *Field visits*: Explore marketing practices for various commodities (food crops, vegetables, fruits, MAPs, livestock) by interacting with producers and traders.	2:00	Sharma, D. (2021). *Agricultural marketing systems in Nepal: Issues and reforms.* Journal of Agricultural Economics, 10(3), 45-59.
		1.6. Institutions involved in agricultural marketing in Nepal; roles of government and private sector institutions	1:00	1.7. *Study tour*: Visit key agricultural marketing institutions to understand their operations, challenges, and impact.	1:00	Adhikari, R., & Shrestha, S. (2023). *The role of institutions in agricultural market development in Nepal.* Journal of Rural Development Studies, 17(2), 111-127.

II	Market Information and Value Chain	2.1 Demand forecasting methods, ICT in agriculture marketing, market intelligence, and advanced marketing strategies (4Ps, Ansoff's matrix, SWOT analysis)	1:00	2.2. *Practical exercise*: Apply demand forecasting models to estimate demand for milk and meat, incorporating M4P analysis.	2:00	Ahuja, S., & Rathi, S. (2020). *Market intelligence in agricultural marketing: Emerging trends and ICT integration*. Agricultural Information Review, 19(4), 1-8.
		2.3. Marketing functions, channels, value chains, supply chain, and power dynamics in value chains; concept of upstream and downstream actors	1:00	2.4. *Group work*: Conduct a comprehensive value chain analysis of agricultural commodities such as dairy, fruits, vegetables, and MAPs to identify key stakeholders and value drivers.	2:00	Singh, R. (2022). *Value chain analysis in agricultural marketing: A case study of dairy and vegetable sectors*. Journal of Agriculture and Rural Economics, 25(3), 76-92.
III	Cooperatives in Marketing	3.1 Cooperative concept, principles, values, history, and current status in Nepal; the role of cooperatives in rural development	1:00	3.2. *Field study*: Assess the role and effectiveness of agricultural cooperatives, interacting with cooperative managers for insights.	2:00	Shrestha, B. (2021). *Cooperatives in Nepal: Challenges and opportunities for agricultural marketing*. Journal of Cooperative Studies, 7(1), 33-44.
		3.3 Role of cooperatives in marketing cereals, fruits, vegetables, HVAPs; cooperative models for enhancing market access	1:00	3.4. *Case study*: Evaluate the success of cooperatives in marketing cereals, fruits, and vegetables, focusing on strategies and outcomes.	2:00	Karki, B., & Bhattarai, R. (2023). *The role of cooperatives in agri-marketing: A case study of high-value crops*. Nepal Journal of Cooperative Development, 12(2), 55-72.
		3.5 Agricultural input marketing and the role of cooperatives; cooperative-based agricultural input supply systems	1:00	3.6. *Practical analysis*: Investigate the mechanisms of cooperative-led agricultural input supply systems within local communities, analyzing their efficiency and impact.	2:00	Lamichhane, B., & Thapa, G. (2020). *Cooperatives and agricultural input marketing in Nepal: An assessment*. Journal of Agricultural Economics and Development, 15(1), 41-58.
IV	Marketing Efficiency and Government Intervention	4.1 Concept and tools of marketing efficiency measurement (cost-benefit analysis, price transmission analysis); role of market intermediaries	1:00	4.2. *Group work*: Analyze marketing efficiency for MAPs and apples, comparing performance across different marketing channels and identifying areas for improvement.	2:00	Joshi, S., & Poudel, P. (2021). *Measuring marketing efficiency in agricultural markets: A case of MAPs and fruits*. Nepal Journal of Agricultural Economics, 14(2), 98-112.
		4.3 Government interventions to stabilize and improve marketing; price controls, subsidies, and market infrastructure development	1:00	4.4. *Group practice*: Study the roles and responsibilities of the three tiers of government in agricultural marketing, evaluating current policies and their effectiveness.	3:00	Ministry of Agriculture and Livestock Development. (2022). *Government interventions and their impact on Nepal's agricultural marketing*. Kathmandu: MOALD.
		4.5 Price variation (spatial and temporal), price discrimination, pricing systems in Nepal; role of price discovery mechanisms	1:00	4.6. *Field assessment*: Investigate price variations in agricultural commodities, focusing on temporal price changes for vegetables and spatial price changes for staple crops, with data collection and analysis.	3:00	Rajbhandari, B. (2020). *Price variation and its implications on Nepalese agricultural markets*. Journal of Rural Economics, 9(4), 67-81.
V	International Trade in	5.1 Concepts of business, trade, and commerce; role of trade in the economy; trends and patterns in Nepa agri-trade		*Practical analysis*: Examine the contribution of al trade to Nepal's GDP, analyzing relevant tatistics and reports.	2:00	Poudel, A. (2023). *The role of agricultural trade in Nepal's economy: A review*. SAARC Journal of Economic Studies.

	Agriculture					18(1), 22-34.
		5.3 Trade liberalization, globalization; tariff and non-tariff barriers; regional trade agreements (SAFTA, BIMSTEC, etc.)	1:00	5.4. *Group work*: Identify trade barriers affecting Nepalese agriculture and evaluate the impact of trade liberalization on agricultural growth.	2:00	Aryal, D. (2021). *Agricultural trade barriers and liberalization: Impact on Nepal's agriculture.* Nepal Trade and Development Review, 6(3), 123-136.
		5.5 Concepts of trade balance, trade surplus/deficit, BoP and BoT; implications for agricultural exports	1:00	5.6. *Class work*: Analyze Nepal's agricultural trade position by reviewing import-export data, the balance of trade (BOT), and the role of agriculture in overall trade balance.	2:00	Shrestha, T. (2022). *Trade balance and Nepal's agricultural export policy.* Nepal Journal of International Trade, 7(2), 45-58.
		5.7 Nepal's trade policies, WTO, SAFTA, GATT, BIPPA, NTIS; transition to NADP and the role of foreign aid in trade	1:00	5.8. *Project work*: Conduct a gap analysis of Nepal's agricultural trade policies, comparing them with international trade agreements to identify alignment and areas for improvement.	4:00	Puri, S. (2020). *Nepal's trade policies and global integration: Challenges and opportunities.* Journal of International Economics, 28(1), 105-118.
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**32:00**	

Course Syllabus

Course Code: ECO460 Semester VI

Course Title: Agriculture Development Plan & Policy *Credit Hours:* 3 [Theory: 1; Practical: 2]

Teaching Hours: 48

Course Description: This course provides an in-depth understanding of the planning processes, policy formulation, and strategic interventions in agricultural development. It equips students with the analytical tools to evaluate agricultural policies, development programs, and institutional frameworks. Emphasizing the connection between agriculture and broader economic development goals, the course tackles issues such as food security, poverty reduction, sustainability, and climate resilience. Students will explore both historical and contemporary policy approaches and develop strategies for designing inclusive, evidence-based agricultural policies.

Course Objectives: This course aims to deepen students' understanding of agricultural planning, policy formulation, and strategic interventions. It equips students with analytical tools and critical thinking skills to evaluate agricultural policies, development programs, and institutional frameworks. The course emphasizes the link between agriculture and broader economic goals, focusing on issues like food security, poverty reduction, sustainability, and climate resilience.

a. Understand agricultural planning and policy processes,
b. familiarize with policy analysis and planning tools, and
c. enable students to propose evidence-based policy recommendations for agricultural development.

Course Contents:

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Agricultural Planning and Policy	1.1. Concepts of plan, project, and program and their interrelationship; features of agricultural development policies and gaps	2:00	1.2. *Group Discussions*: Critical review of APP and ADS	4:00	Koirala, M. (2009). *Agricultural policy in Nepal: Challenges and opportunities.* Kathmandu: Agro-Insight. Shrestha, S., & Pokhrel, D. (2016). Agricultural development policies in Nepal. *Journal of Rural Development*, 35(1), 45-58.
		1.3. Agricultural development policy mapping (three tiers); genesis and evolution of agricultural projects (PMAMP) and programs	2:00	1.4. *Micro-presentations*: Mapping of agricultural development policies and gap analysis	3:00	
		1.5. Agricultural development plans: long-term, medium-term, and short-term plans (e.g., Five-Year Plans, APP, ADS)	2:00			
II	Agriculture and Economy Develop	2.1. Present situation of Nepalese agriculture: Holding size, commodity-wise area and production; number of livestock and production	1:00	2.2. *Group work*: Trend analysis of agricultural production and productivity, sector-wise composition of the economy	3:00	Malla, S. (2014). Nepal's agricultural economy: A comparative analysis. *Nepalese Journal of Development*, 25(3),

	ment	2.3. Key features of the Nepalese economy and its dependency on agriculture	1:00	2.4. *Case study*: The role of agriculture in rural economy and poverty reduction	3:00	89-102. Sharma, K. R. (2012). Nepal's economy and agricultural challenges. *Economic Review*, 29(1), 21-40.
		2.5. Sector-wise share to GDP and economic trends	1:00	2.6. *Data analysis*: Trends in sectoral contributions to GDP	4:00	
		2.7. Obstacles to agricultural development in Nepal (infrastructure, policy barriers, climate change	1:00	2.8. *Project Work*: Assessment of agricultural development prospects and marketing challenges	3:00	
III	Food Security and Poverty Reduction	3.1 Concept of food & nutrition security; dimensions and current status of food security	1:00	3.2. *Guided discussions*: Assessment of food and nutrition security issues	3:00	FAO. (2014). *The state of food insecurity in the world*. Food and Agriculture Organization. Pandey, R., & Thapa, G. (2015). Poverty and agricultural development in Nepal: An empirical analysis. *Journal of Nepalese Development*, 4(2), 60-72.
		3.3. Poverty: Types, measurement, and current status; poverty reduction strategies and their effects	2:00	3.4. *Data analysis*: Poverty trends in agricultural regions	3:00	
		3.5. Government initiatives for food and nutrition security and their impact	1:00	3.6. *Group practice*: Evaluating government efforts for food security and poverty alleviation	3:00	
IV	Labour Migration and Remittance	4.1. Labour migration's impact on Nepalese agriculture: Labour availability, wages, and remittance use in agriculture	2:00	4.2. *Group Discussions*: Issues related to labour migration, remittance, and their effects on agriculture	3:00	Adhikari, J. (2016). Migration and its impact on agricultural productivity in Nepal. *Migration and Development Journal*, 5(1), 14-29.
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**32:00**	

	ment	2.3. Key features of the Nepalese economy and its dependency on agriculture	1:00	2.4. *Case study*: The role of agriculture in rural economy and poverty reduction	3:00	89-102.
		2.5. Sector-wise share to GDP and economic trends	1:00	2.6. *Data analysis*: Trends in sectoral contributions to GDP	4:00	Sharma, K. R. (2012). Nepal's economy and agricultural challenges. *Economic Review*, 29(1), 21-40.
		2.7. Obstacles to agricultural development in Nepal (infrastructure, policy barriers, climate change	1:00	2.8. *Project Work*: Assessment of agricultural development prospects and marketing challenges	3:00	
III	Food Security and Poverty Reduction	3.1 Concept of food & nutrition security; dimensions and current status of food security	1:00	3.2. *Guided discussions*: Assessment of food and nutrition security issues	3:00	FAO. (2014). *The state of food insecurity in the world*. Food and Agriculture Organization. Pandey, R., & Thapa, G. (2015). Poverty and agricultural development in Nepal: An empirical analysis. *Journal of Nepalese Development*, 42(2), 60-72.
		3.3. Poverty: Types, measurement, and current status; poverty reduction strategies and their effects	2:00	3.4. *Data analysis*: Poverty trends in agricultural regions	3:00	
		3.5. Government initiatives for food and nutrition security and their impact	1:00	3.6. *Group practice*: Evaluating government efforts for food security and poverty alleviation	3:00	
IV	Labour Migration and Remittance	4.1. Labour migration's impact on Nepalese agriculture: Labour availability, wages, and remittance use in agriculture	2:00	4.2. *Group Discussions*: Issues related to labour migration, remittance, and their effects on agriculture	3:00	Adhikari, J. (2016). Migration and its impact on agricultural productivity in Nepal. *Migration and Development Journal*, 5(1), 14-29.
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**32:00**	

Course Syllabus

Semester VII

Course Code: ECO470 ***Credit Hours:*** 2 (Theory: 1, Practical: 1)
Course Title: Survey Research Methodology ***Teaching Hours:*** 32
Course Description: This course provides a comprehensive understanding of survey research methodology, including the process of designing, conducting, analysing, and reporting surveys. It emphasizes key elements such as research design, sampling techniques, data collection tools (such as questionnaires), hypothesis testing, project planning, monitoring, and impact assessment. The course integrates both theoretical and practical aspects, enabling students to understand the applications of surveys across various disciplines like social sciences, agriculture, health, and development.

Course Objectives: This course aims to provide students with a solid foundation in survey-based research, covering design, questionnaire development, data collection, and analysis. It focuses on:

a. Understanding the key concepts and applications of survey research across disciplines,
b. developing skills to design effective survey instruments, and
c. preparing professional reports and presentations to communicate findings to stakeholders.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
1	Socio-economic Research Studies	1.1. Research concept, objectives, types (qualitative, quantitative, mixed), process, steps and approaches	1HH	1.2. Group Discussions: Explanation of research process and approaches in socio-economic studies	2HH	Kothari, C. R. (2004). Research methodology: Methods and techniques (2nd ed.). New Age International Publishers. Creswell, J. W. (2014). Research design: Qualitative, quantitative, and mixed methods approaches (4th ed.). SAGE Publications.
		1.3. Key elements of socio-economic research report	1HH	1.4. Micro presentations: Proposal preparation and presentation using real/local case studies	1HH	
2	Research Design and Data tools	2.1. Sampling techniques and sample size determination	2HH	2.2. Group work: Exercises on appropriate sampling methods and size calculation for socio-economic research	1HH	Bhattacherjee, A. (2012). Social science research: Principles, methods, and practices (2nd ed.). Creative Commons.
		2.3. Questionnaire development, pilot testing, structured and semi-structured formats, ethical issues	2HH	2.4. Project Work: Field practice in questionnaire design, pre-testing, and pilot surveys	2HH	Saleem, M. (2021). Research methods for business: A skill-building approach.

		2.5. Hypothesis formulation, test of significance (t-test, chi-square, ANOVA), parametric & non-parametric methods	4:00	2.6. *Group work*: Hypothesis formulation and testing using real data and interpretation of results	2:00	*building approach* (4th ed.). John Wiley & Sons.
III	**Project Planning and Evaluation**	3.1. Concept of ZOPP (Goal-Oriented Project Planning), problem tree, objective tree, decision tree	2:00	3.2. *Guided Discussions:* Tree analyses and logical framework development	2:00	Patton, M. Q. (2008). *Utilization-focused evaluation* (4th ed.). SAGE Publications. Schilling, M. A. (2016). *Strategic management of technological innovation* (5th ed.). McGraw-Hill Education.
		3.3. Project scheduling tools: PERT, CPM, Gantt chart, milestone tracking	2.00	3.4. *Group practice:* Hands-on exercise on planning tools: chart creation and analysis	2:00	
IV	**Monitoring and Impact Assessment**	4.1. Concepts, purpose, methods and tools of M&E in agricultural and rural development projects	1.00	4.2. *Case study analysis*: Monitoring and evaluation of livestock/agriculture project	2:00	Taylor-Powell, E., & Renner, M. (2003). *An overview of qualitative research methods.* University of Wisconsin-Extension. Retrieved from https://learningstore.uwex.edu Patton, M. Q. (2008). *Utilization-focused evaluation*
		4.3. Project results chain: output, outcome, effect, impact; impact assessment methods (before-after, with-without)	1.00	4.4. *Group work*: Impact evaluation using tools like control group, PRA, cost-benefit analysis	2:00	
Total hours of thematic teaching-learning			16:00	**Total hours of practical activities**	16:00	

Mid-West University (MU)
Office of the Dean
Graduate School of Agriculture and Forestry
Birendranagar, Surkhet
Rural and Urban Sociology
Semester I

Code: EXT 414
Course Title: Rural Sociology

Credit Hours: 2 [Theory: 1; Practical: 1]
Teaching Hours: 32

Course Description: This course comprises studying Foundations of Sociology; Meaning, nature, importance and branches of Rural Sociology and Urban Sociology, Differences in Rural and Urban Society, Concept of Society, its Characteristics, Elements, types and Functions. Concept, meaning and methods of sociological study, functionalist theory, conflict theory and symbolic interactionism theory, Rural societies of Nepal and characteristics, caste ,ethnicity, culture, traditions, rituals, religion, language/local dialects, Social process (process of social interaction): basic concepts; accommodation, adjustment, amalgamation, assimilation, cooperation, consensus, competition, conflict and integration, Social institutions: Social Institutions: Characteristics, Elements, Functions, and Types of Institutions. Concept and meaning, sources and factors of social change. Socialization: meaning, stages and agents of socialization, Overview of theories of socialization/self by Cooley, Mead and Freud, Social stratification and its classification: Caste, class, gender and Ethnicity, Organization: Definition, Concept, meaning, Types, Characteristics, elements, Function and Principles. Conflict: stages, conflict intensity continuum and conflict management, Meaning of social group, group types, Characteristics of groups, Factors to be considered in forming group, organization of group, stages of group formation. Roles of personality, motivation, attitudes and perceptions in agricultural extension, Psychology and education psychology, its importance in Agriculture extension Education.

Course Objectives: The general objective of this course is to provide students with a comprehensive understanding of Rural and Urban Sociology. Especially, this course aims to:-

a. Get acquainted with and understand the basic concepts of rural & urban society,
b. impart knowledge on Social Process, institution, Socialization, social stratification and Social Change, and
c. apply sociological concept Organization, Conflict Management, Social Groups, Psychology and Education psychology.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				Reference
		Theoretical Elements of Leaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Foundations of Sociology	1.1 Meaning, nature, importance, and branches of Rural and Urban Sociology. Differences between Rural and Urban Societies.	1:00	1.2. *Group exercise:* Prepare an interview format and schedule to study the social characteristics of rural society	2:00	Acharya, B. R. (2022). Introduction to Sociology. National Book Center, Kathmandu, Nepal. Flanagan, W. G. (2010). Urban sociology: images and structure. Rowman & Littlefield. Dongol, B. B. S. (2021). Extension Education. (Third Edition, ISBN 9789937703147.) Heritage Publishers & Distributors Pvt. Ltd., Kathmandu, Nepal. Sapkota, B. (2018). Rural Sociology. Vidhyarthi Pustak Bhandar, Kathmandu, Nepal.
		1.3 Concept of Society: Characteristics, Elements, Types, and Functions.	1:00	1.4 *Field Visit:* Visit a rural or urban society to study the characteristics of rural/urban communities.	2:00	
		1.5 Sociological Study: Concept, Meaning and Methods, Theories	1:00	1.6 *Field Visit:* Conduct surveys to gather information on	2:00	

		(Functionalism, Conflict Theory, Symbolic Interactionism).		Socioeconomic aspects of society		
		1.7 Rural Societies of Nepal: Characteristics, Caste, Ethnicity, Culture, Traditions, Rituals, Religion, Language/Local Dialects.	1:00	1.8 *Field Visit:* Identify taboos, folkways, rituals, and social values in the village.	1:00	
II	Social Process and Institutions	2.1 Social Processes: accommodation, adjustment, amalgamation, assimilation, cooperation, consensus, competition, conflict and integration	1:00			Bhushan, V. and D.R. Sachdeva. 2000. An introduction to sociology. Kitab Mahal, India. Chitambar, J.B. 2015. Introductory rural sociology. New Age International Publishers, India Regmi, R.R. 2001. The essentials of sociology. Sandeep Raj Regmi, Kath.
		2.2 Social Institutions: Characteristics, Elements, Functions, and Types of Institutions. Concept and meaning, sources and factors of social change	2:00	2.3 *Group exercise:* Study rural social institutions and organizations: school, cooperative, rural municipality/local government authorities. Study the workings of basic rural institutions	2:00	
III	Socialization, Stratification, Change and Conflict	3.1 Socialization: Stages and Agents of Socialization. Theories by Cooley, Mead, and Freud. Social problems	1:00	3.2 *Class Discussion:* Discuss in Groups to identify social problems and their solutions.	1:00	Subedi, M. and Uprety, D. (2014).The State of Sociology and Anthropology - Teaching and Research in Nepal.Martin Chautari, Kathmandu, Nepal.
		3.3 Social stratification and its classification: Caste, class, gender and Ethnicity.	1:00	.		
		3.4 Organization: Definition, Concepts, Types, Characteristics, Functions, and Principles.	2:00	3.5. *Class Discussion:* Study about your organization and its functions.	1:00	
		3.6 Conflict: Stages, Intensity Continuum, and Conflict Management.	1:00			
IV	Social Groups and Leadership	4.1 Social Groups: Meaning of social group, group types, Characteristics of groups	1:00	4.2 *Field Visit*: Visit a rural community to identify different social groups farmers are associated with.	2:00	Thorndike, E. L. (1913). Educational Psychology.. (Vol. 2). Teachers college, Columbia university. Matthews, G., Deary, I. J., & Whiteman, M. C. (2003). Personality traits. Cambridge University Press. Ajzen, I. (2005). Attitudes, personality
		4.3 Factors to be considered in forming group, organization of group, stages of group	1:00	4.4 *Group Discussion:* Discussion tin group understand group meetings	1:00	

		formation		and decision processes.		and behaviour. McGraw-hill education (UK).
		4.5 Psychology and education psychology, its importance in Agriculture extension Education	1:00			
		4.6. Roles of personality, motivation, attitudes and perceptions in agricultural extension	1:00	4.7.*Group Practice :* Practice on personality and intelligence measurement techniques (group exercise)	2:00	
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**16:00**	

Mid-West University (MU)
Office of the Dean
Graduate School of Agriculture and Forestry
Birendranagar, Surkhet
Extension Education
Semester III

Code: EXT 433

Course Title: Extension Education

Credit Hours: 3.0 *[Theory: 1.0; Practical: 2.0]*
Teaching Hours: 48:00

Course Description: This course comprises learning of Concept of Education, types of education, Extension education, Scope and Importance of agricultural extension in agriculture & rural development, Historical events of agriculture extension in the world and Nepal. Scope & function of agricultural extension, Philosophy & principles of extension education, Concept of training and its approach, types, cycle, phase, Concept of entrepreneurs, entrepreneurship development. Steps/stages of Entrepreneurship Process. Typology of entrepreneurs, Factors affecting entrepreneurship development, extension teaching methods and classification, Concept of innovation; Process of innovation decision and steps of innovation decision; Adopters categories and its characteristics; Concept of technology and agriculture technology and its types. Concept of technology transfer (ToT); Function of technology generation, development and dissemination, Agriculture technology transfer process and steps; Research, Extension & Education linkage system; Concept of leader and leadership; GoN practice of program planning in agriculture; Basic concept and differences between supervision, monitoring and evaluation, Sustainable Development Goals and Agriculture Policy and Priorities of National, Provincial and Local government for agricultural extension. Concept of Land Grant College (LGC) in USA and in the world.

Course Objectives: The general objective of this course is to empower the learners with a basic understanding of the concepts, values, and virtues of Extension education. Specifically, this course aims to:-

a. develop student's ability on understand the basic concept of education and extension education,
b. familiar with their principle, philosophy, objective, method, system and practices, and
c. apply the agricultural extension knowledge to the farming community.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Practical Hours	
I	Introduction to Agricultural Extension Education and Entrepreneurship	1.1 Concept of Education, Types of Education, Extension Education, Scope, and Importance of Agricultural Extension in Agriculture & Rural Development.	1:00	1.2 *Observation in field:* Observe and analyze participant interaction in agricultural extension activities.	2:00	Dongol,B.B.S.(2015).Extension Education(2thed.).PrativaDangol, Kathmandu Nepal.
		1.3 Historical Events of Agricultural Extension in the World. Major Historical Changes & Emerging Issues of Extension Services in Nepal.	1:00	1.4 *Group exercise:* Facilitate group discussions on the history and emerging trends in agricultural extension.	2:00	Dasgupta, D. (2008). Extension Education: Core contents and emerging areas. Agrobios Jodhpur, India.

		1.5. Scope & Function of Agricultural Extension in Agriculture & Rural Development. Philosophy & Principles of Extension Education.	1:00	1.6 *Field trip:* Engage in community-based needs assessment and analysis.	2:00	ISBN-10:8177543700 Jaishi, M and I Poudel. Text book social mobilization and community development. Heritage Publisher and PD. TPC, Lamjung Campus.
		1.7 Concept of Training: Differences between Education, Training, and Learning. Approaches, Types, and Phases of Training: Pre-training, Training, and Post-training.	1:00	1.8 *Group exercise:* Demonstrate the use of various teaching methods and relate them to training phases.	2:00	
		1.9 Concept of Entrepreneurs, Entrepreneurship. Steps/Stages of the Entrepreneurship Process. Typology of Entrepreneurs. Factors Affecting Entrepreneurship Development.	1:00	1.10 *Field Visit:* Visit local agro-enterprises and interact with entrepreneurs to understand their challenges and success factors.	2:00	
II	Extension Teaching Methods and Innovation Diffusion	2.1 Concept and Meaning of Extension Teaching Methods (ETM) and their Classification. How to Select ETM.	1:00	2.2 *Presentation exercise:* Conduct or participate in Farmers Field School (FFS)/ Training.	2:00	Roy, G. L. (2011). Extension communication & management. Kalyani publishers. Sapkota, D. (2021). Comparative study of different extension teaching methods for agricultural in Sindhuli district. (Unpublished master's thesis). Tribhuvan University, Kirtipur. Roy, G. L. (2009). Extension Communication and Management (4th ed.). New Delhi: India.
		2.3 Concept of Innovation, Types and Nature of Innovation, Adoption and Diffusion. Concept of Adoption and Types of Adoption Decision.	1:00	2.4 *Group practice:* Develop an extension plan based on the logical framework approach.	2:00	
		2.5 Process of Innovation Decision and Steps of Innovation Decision.	1:00	2.6 *Field Visit:* Observe and analyze planning processes at the agriculture section of a local municipality.	2:00	
		2.7 Adopters Categories and Characteristics. Factors Affecting Diffusion of Innovation.	1:00	2.8 *Group practice:* Review and compare extension methods adopted by local and international agencies.	2:00	
III	Technology Transfer & Agricultural Information Systems	3.1 Concept of Technology, Types of Agricultural Technology, and Technology Transfer (ToT) in Nepal.	1:00	3.2 *Exposure learning:* Organize or and participate in agriculture extension campaign	2:00	Roy, G. L. (2011). Extension communication & management. Kalyani publishers. Sapkota, D. (2021). Comparative study of different extension teaching methods for agricultural in Sindhuli district. (Unpublished master's thesis). Tribhuvan University, Kirtipur.
		3.3 Agricultural Knowledge and Information System, Agricultural Innovation Management System, and Agricultural Development.	1:00	3.4 *Group work:* Participate in conducting agricultural method/result demonstrations.	2:00	
		3.5 Research-Extension-Education Linkage System in Nepal: Its Importance and How to Make REE Linkage Effective.	1:00	3.6 *Presentation:* Develop and present a program plan using the logical framework.	2:00	

		3.7 Concept of Leadership and Leadership Styles. Differences between a Leader and a Manager. Leadership Development Models.	1:00	3.8 *Group exercise:* Conduct role play to demonstrate different leadership style.	2:00	[Unpublished master's thesis]. Tribhuwan University University.
		3.9 Program Planning: Definition, Principles, Process, and Stages of Program Planning.	1:00	3.10 *Group exercise:* Steps of program planning. Modern tools for analysis of situation: SWOT analysis. Identify the problems and needs: setting the objectives of the program	2:00	
IV	Supervision, Monitoring, Evaluation & Sustainable Development	4.1 Concept and Differences between Supervision, Monitoring, and Evaluation. Monitoring & Evaluation Indicators: Input, Process, Output & Impact Indicators.	1:00	4.2 *Planning and evaluation:* Develop and prepare an evaluation plan for agricultural extension activities.	2:00	Kumar, B. and Hansra, B.H. (2000). Extension Education for Human Resource Development Concept Publishing Company, New Delhi, India.
		4.3 Sustainable Development Goals and Agriculture Policy and Priorities of National, Provincial, and Local Government for Agricultural Extension. Concept of Land Grant College (LGC) in the USA and in the World.	1:00	4.4 *Presentation:* Write and present evaluation reports of agricultural extension programs/events.	2:00	Jaishi, M.B., Bishwakarma, K. and Shahi, L. (2015). Fundamentals of extension education: A practical manual for undergraduate students. Mahesh Jaishi, Kathmandu, Nepal.
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	32:00	

Mid-West University (MU)
Office of the Dean
Graduate School of Agriculture and Forestry
Birendranagar, Surkhet
Communication and Social Mobilization
Semester VI

Course Code: EXT 461
Course Title: Communication and Social Mobilization
Credit Hours: 3 [Theory: 1; Practical: 2]
Teaching Hours: 48

Course Description: This course covers Introduction to Communication, Overview of timeline of communication development, Principles, process, models, Effective Communication. forms, types and system of Communication of Communication. Theories of Communication, Barriers of communication. Policy and media of Communication. Information and Communication Technology (ICT), Artificial Intelligence (A.I) and Agricultural Journalism. Concept: meaning, definition and purpose of social mobilization, Stage/phases/dialogue. Qualities of Social mobilizer, Participatory learning and action tools for social mobilization, Tools & techniques of PRA/ RRA, gender analysis, Diagram and mapping, Discussion and Interview.

Course Objectives: The general objective of this course is to provide students with a comprehensive understanding of Communication and Social Mobilization. Especially, this course aims to-

a. Conceptualize Communication, its principles, process, Process, Theories, barriers, Policy,
b. familiarize Information and Communication Technology (ICT) tools and techniques, Artificial Intelligence (A.I) and Agricultural Journalism, and
c. introduce Concept of Development, Urban Development, Social Mobilization, Social Mobilization concept, phages, tools, Strategy of Rural and Urban Development.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				Reference
		Theoretical Elements of Leaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Communication Basics	1.1 Introduction to Communication: Meaning, Definition, Scope, Importance, and Function of Communication. Overview of Timeline of Communication Development.	1:00	1.2 *Group exercise:* Designing and Preparation of Communication Materials (Leaflet/Folder/Booklet).	2:00	Chauhan, J. (2008). Communication in agriculture. Dubey, V.K. and I. Bishnoi. 2009. Extension education and communication. New Age International Publishers, New Delhi, India. Dahama, O.P. and O.P. Bhatnagar. 2009. Education and communication for
		1.3 Communication as a Process: Elements of Communication, Communication Process, Communication Models.	1:00	1.4 *Class work:* Analysis of Elements of Communication through Audio/Video Programs or Documents.	2:00	

		1.5 Effective Communication Skills.	1:00	1.6 *Design work:* Designing and preparing banners and posters for communication.	2:00	development. Oxford and IBH publishing company pvt. Ltd. New Delhi, India. Robbins, S.P., T.A. Judge and S. Sanghi. 2009. Organizational behavior. Prentice Hall, India.
		1.7 Forms, Types, and Systems of Communication (Verbal, Non-verbal, Written, Individual, Group, and Mass).	1:00	1.8 *Group exercise:* Preparing visual charts (Tree, Flow, and Organizational).	2:00	
II	Communication Theories & Barriers	2.1 Theories of Communication: Hypodermic Needle Theory, Two-Step Theory, Agenda Setting Theory, Cultivation Theory, and Cognitive Dissonance Theory.	1:00	2.2 *Presentation:* Designing Slides and Presentation of Skill Development through Microsoft PowerPoint.	2:00	Fiske, J. (2016). Introduction to communication studies. Routledge. Sandhu, A.S. 2014. Textbook on agricultural communication: process and method. Oxford and IBH publishing company pvt. Ltd. New Delhi, India. Ministry of Information and Communication, Government of Nepal (2015).National Information and Communication Technology Policy,2015. Singhadurbar, Kathmandu, Nepal
		2.3 Barriers of Communication: Types of Barriers and Strategies to Overcome Them.	1:00	2.4 *Group work:* Designing and organizing a communication campaign/ meeting/ workshop.	2:00	
		2.5 Overview of Communication-Related Policy and Media of Nepal.	1:00	2.6 *Design and Preparation:* Preparation of Agricultural News Cover/Success Story.	2:00	
III	ICT, A.I. & Agricultural Journalism	3.1 ICT Tools and Techniques: Printed Media, Electronic Media, Multimedia, Mobile Phones, Video, Application of ICT in Agriculture, Artificial Intelligence (A.I).	1:00	3.2 *Project work:* Apply Artificial Intelligence in Agriculture project and present.	2:00	Singh, R., Gehlot, A., Prajapat, M. K., & Singh, B. (2021). Artificial Intelligence in Agriculture. CRC Press. Chowhan, S., & Ghosh, S. R. (2020). Role of ICT on agriculture and its future scope in Bangladesh. Journal of Scientific Research and Reports, 26(5), 20-35. Baura, Jayanti. (2001). Social Mobilization and Modern Society. Mittal Publications, New Delhi, India Jaishi, M & I. Paudel (2020). Social Mobilization and Community Development; A practical guide for undergraduate student. Heritage Publishers and RD-TEC, Lamjung Campus. Khan,S.S. and J.S sah. (2001). Social molilization Manual Based on Syangja Experience, Social Mobilization Experimentation and Learning Centre.
		3.3 Agricultural Journalism: Scope, Importance, and Its Role in Agricultural Development.	1:00	3.4 *Field Visit:* Observing operations at a news broadcasting or publishing office.	2:00	
IV	Development & Social Mobilization	4.1 Basic Concept of Development: Concept of Development, Urban Development, and Sustainable Development.	1:00	4.2 *Group Exercise:* Conducting social mobilization exercises using PRA/RRA tools.	2:00	
		4.3 Basic Concept: Meaning, Definition, Purpose of Social Mobilization, Terminologies, and Typologies of Social Mobilization.	1:00	4.4 *Acknowledgement:* Selecting and implementing appropriate participatory learning tools.	2:00	
		4.5 Stage/Phases/Dialogue of Social Mobilization.	1:00	4.6 *Group work:* Conducting focus group discussions and problem-solving exercises.	2:00	
		4.7 Strategy of Rural and Urban Development: Rural and Urban Development.	1:00	4.8 *Project work:* Implementing gender analysis tools in development strategies.	2:00	
		4.9 Participatory Learning and Action Tools and Techniques for Social Mobilization:		4.10 *Presentation:* Studying government social mobilization and	2:00	

		Concept of PRA, RRA, PLA and Its Use in Development. Tools & Techniques of PRA/RRA Used in Social Mobilization Process, Gender Analysis Tools.	1:00	resource mobilization guidelines.		
		4.11 Diagram and Mapping: Resource Mapping, Venn Diagram, Social Mapping, Institutional Mapping, Mobility Map, Activity Profile, Problem Solving Tree, and Seasonal Calendar.	1:00	4.12 *Group Exercise:* Conduct Resource Mapping, Venn Diagram, and Social Mapping.	2:00	
		4.13 Discussion and Interview: Focus Group Discussion, Semi-structured Interview, Its Probing Techniques, Enumerator's Role in Interview.	1:00	4.14 *Learning exercise:* Showing Enumerator's Role in Interview.	2:00	
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**32:00**	

Semester VII

Course Code: EXT471
Course Title: Designing Agro Tourism Development
Credit Hours: 2 [Theory: 1; Practical: 1]
Teaching Hours: 32

Course Description: This course focuses on studying with an emphasis on Introduction to Tourism, Rural/Village tourism, Agro tourism, Agro tourism Development, policies & strategies. Concepts, type and status of Tourism, Historical background of Tourism in Nepal, Carrying capacity and its types, Opportunities and Limitations of tourism in Nepal, Contemporary issues of tourism development in Nepal, Rural /Village tourism in Global Context, its benefits, Promotion of Rural tourism , Driving force of Rural tourism and its management in Nepal, its growth and Development, Opportunities and Challenges of Rural tourism in Nepal, Meaning, prospects, scope and Importance of Agro tourism, agro tourism in Nepal. Relation of agro tourism with other disciplines, SWOT analysis of Agro tourism, Difference between Ecotourism, agro tourism and Rural tourism, agro tourism Development. Role Indigenous knowledge and technologies for agro tourism development, Agro tourism Development Models, Agro tourism Farms. Sustainability of agro tourism, Policies and strategies related to agro tourism in Nepal, Impacts of agro tourism.

Course Objectives: The general objective of this course is to provide students with a comprehensive understanding of agro tourism Development. Especially, this course aims to-

a. Impart learners on fundamental Introduction, History, Carrying capacity, Opportunities, limitation and issues of Tourism,
b. familiarize Rural/village tourism, its Promotion, Management, and
c. introduce Agro tourism, its Planning and development, its Relation, Agro tourism Development, Sustainability, policies, strategies and Activities, Destinations, impacts.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				Reference
		Theoretical Elements of Leaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction to Tourism	1.1 Basic Introduction, Concepts, Type, and Status of Tourism	1:00	1.2 *Study visit:* Exploration Visit to Tourist Destinations in local area	1:00	Robinson, P. (2012). Tourism: The key concepts. Routledge. Jayapalan, N. (2001). Introduction to tourism. Atlantic Publishers & Dist. Thapa, D. (2013). Development of agrotourism in nepal, an alternative to emigration for nepalese youths: Case: Bishram Batika Restaurant. Stevens, S. (1988). Tourism and development in Nepal. *Kroeber Anthropological Society Papers*, 67(68), 67-80.
		1.3 Historical Background of Tourism in Nepal	1:00	1.4 *Field Visit:* Collection and Documentation of Food and Beverage items in Karnali Agritourist Area	2:00	
		1.5 Carrying Capacity and Its Types, Opportunities and Limitations of Tourism in Nepal	1:00			
		1.6 Contemporary Issues of Tourism Development in Nepal	1:00			
II	Rural/Village Tourism	2.1 Rural/Village Tourism in Global Context, Its Benefits	1:00			Lane, B. (2009). Rural tourism: An overview. The SAGE handbook of

		2.2 Promotion of Rural Tourism, Driving Forces, and Management in Nepal	2:00	2.3 *Study and Acknowledge:* Study of the Promotion and Growth of Rural Tourism in Nepal	1:00	tourism studies, 354-370.
		2.4 Opportunities and Challenges of Rural Tourism in Nepal	1:00	2.5 *Presentation:* Presentation on Opportunities and Challenges of Rural Tourism in Nepal	1:00	
III	Agro tourism Development and Sustainability	3.1 Meaning, Types, Prospects, Scope, and Importance of Agro tourism in Nepal, Planning and Development Steps	2:00	3.2 *Demonstration:* Extension of Resilient Agro ecological Practices and Local Indigenous Knowledge from Community Learning Centers for Agro tourism	2:00	Astutik, H. P. (2017). Strategy of Agro Tourism Development in Gombengsari District Banyuwangi. Journal of Business on Hospitality and Tourism, 3(1), 38-54. Khanal, S., & Shrestha, M. (2019). Agro-tourism: Prospects, importance, destinations and challenges in Nepal. Archives of Agriculture and Environmental Science, 4(4), 464-471. Ana, M. I. (2017). Ecotourism, agro-tourism and rural tourism in the European Union. Cactus Tourism Journal, 15(2), 6-14.
		3.3 Relationship of Agro tourism with Other Disciplines, SWOT analysis of Agro tourism	1:00	3.4 *Group exercise:* Conducting SWOT analysis of local Agro tourism potential	2:00	
		3.5 Difference between Ecotourism, Agro tourism, and Rural Tourism, Role of Indigenous Knowledge, and Technologies for Development	1:00	3.6 *Study and Acknowledge* : Study the differences between Ecotourism, Agro tourism, and Rural Tourism	1:00	
		3.7. Agro tourism Development Models, Agro tourism Farms	1:00	3.8. *Field/ Demonstration:* Design Agro tourism/farms model for Tourism Growth	1:00	
		3.9. Sustainability of Agro tourism, its exploration, Functions, and Responsibility of Local Government	1:00	3.10. *Creation and Exposure :* Creation of Videos/Audio/Vlogs/Blogs Related to Agro tourism	2:00	Badal, B.P., 2019. Tourism: Visit Nepal 2020. Research Nepal Journal of Development Studies (RNJDS), 2(2), pp.12-32. Kaini, M. (2019). Agro-tourism in Nepal: a rural development perspective. Nepalese journal of development and rural studies, 16, 53-65. Khanal, A., Khanal, A., Basnet, F., Joshi, S., &Giri, S. (2024). Agro-tourism in Nepal: Assessment of economic, cultural, and environmental impact. Humanities Journal, 1(2).
		3.11. Policies and Strategies related to Agro tourism in Nepal	1:00	3.12. *Presentation:* Study of Policies and Strategies Related to Agro tourism in Nepal	1:00	
		3.13. Agro tourism Activities and Destinations of Nepal, Impacts of Agro tourism	1:00	3.14. *Field Visit:* Visit to Agro-tourism related Homestay/Cottage/Enterprise in Local Area	2:00	

	and their management	lentil, Collar rot of lentil/chickpea, Fusarium wilt of lentil/chickpea/pigeon pea, Botrytis grey mold of White mold/ Sclerotinia white rot of French bean, pod and stem blight of soybean, Bacterial blight of soybean, mosaic disease of cowpea, soybean, blackgram		Isolation of microbes from soil		(Eds.). (2005). *Diseases of oilseed crops*. Indus Publishing.
IV	Economic importance of fruit and industrial crop diseases and their management	3.3 Major diseases of tropical and subtropical fruits and their management (Fusarium wilt of Banana, Bacterial wilt (Moko) disease of banana, Sigatoka disease of banana, Bunchy top of banana, Mango malformation, Wilt of guava, Citrus greening (Huanglongbing) disease of citrus, collar rot of citrus, Stem canker of dragon fruit, Bacterial Soft rot of dragon fruit, Wilt of avocado, Root knot nematode of kiwi, Botrytis grey mold of strawberry, Soft rot of orange	3	3.4 Market visit : Visit of agro-vet for the study of available chemical fungicides, bacteriocide and biocontrol agents	2	Srivastava, J. N., & Singh, A. K. (Eds.). (2022). *Diseases of Horticultural Crops: Diagnosis and Management: Volume 1: Fruit Crops*. CRC Press.
		3.5 Major diseases of temperate fruits and industrial cropsand their management (Collar rot of apple, papery bark of apple, Apple scab, red rot of sugarcane, stem and root rot of jute	1	3.6 *Lab work* :Preparation of Bordeaux mixture and Bordeaux paste	1	Srivastava, J. N., & Singh, A. K. (Eds.). (2022). *Diseases of Horticultural Crops: Diagnosis and Management: Volume 1: Fruit Crops*. CRC Press.
			16:00		16:00	

LaxmanAryal
NARC, Bhairahawa

3.1 Course Syllabus

Semester III

Course Code: PLB439 *Credit Hours:* 2 [Theory: 1.0; Practical: 1.0]

Course Title: Biochemistry and Plant Physiology *Teaching Hours:* 32:00

Course Description: This course comprises learning of basic concepts, structure, functions of Biomolecules and their role in Plant Physiology.

Course Objectives: The general objective of this course is to empower the learners with a basic understanding of the concepts about

a. Structure, properties and functions of Biomolecules,
b. metabolism in plant
c. basic concept of plant physiology

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Leaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction	1.1. Introduction, scope and application of Biochemistry.	00:30	1.2. *Demonstration:* To observe different Biochemical and Physiological equipments and mention their functions.	01:00	Lehninger, A.L. 1975. Principle of Biochemistry. Kalyani Publishers New Delhi, India.
		1.3. Water, pH, Henderson Hasselbalch equation and buffers.	00:30	1.4. *Lab preparation* laboratory preparation of Standard solutions of acid and alkalies	01:00	Well, J.H. 1990. General Biochemistry, Wiley Eastern Ltd. New Delhi
		1.5. Importance of Biological Buffers in Plants.	00:30	1.6 *Lab preparation* laboratory preparation of Standard solutions of Buffers of different pH and measurement of pH by pH meter.	01:00	Conn, E. E., P.K. Stumpf. G. Brueing and H.D. Roy. 1987. Outlines of Biochemistry. John Wiley & Sons, New York.
II	Bio molecules	2.1. Classification, structure and functions of Amino acids.	01:00	2.2 *Qualitative test:* To identify Amino Acids in given solutions.	01:00	
		2.3 Classification, structure and functions of Carbohydrates.	01:30	2.4. *Qualitative test:* To identify Carbohydrates in given solutions.	01:00	
		2.5. Classification, structure and functions of Lipids.	01:30	2.6. *Qualitative test:* To identify lipids in given solutions.	01:00	
		2.7. Nucleotides and Nucleic acid.	01:30	2.8. *Lab Work*: Titration curve of		

				amino acids.		
III	Enzymes and metabolism	3.1. Enzyme introduction, terminology, nomenclature and classification, properties, mechanism of enzyme action, factors affecting enzyme activity, enzyme inhibition.	01:30	3.2. *Colorimeter:* Quantitative estimation of Bio-molecules by colorimeter.	01:00	
		3.3.Glycolysis, TCA cycle, oxidation and Biosynthesis of Fatty acid, Calvin cycle(starch,sucrose biosynthesis) Amino acid and Protein metabolism	02:00	3.4. *Lab work:* Estimation of glucose in given solution.	01:00	
				3.5 *Lab work:* Estimation of total Protein in given solution by Biuret Method	01:00	
				3.6 *Lab work:* Demonstration of Gel electrophoresis of DNA.	01:00	
IV	Plant Physiology	4.1 Introduction to plant physiology	00:30	4.2. *Lab work:* Isolation of Cell Organelles by Centrifugation.	01:00	Devlin, R.M. and R.H. Witham. 1986. Plant Physiology. CBS Publication and Distribution, New Delhi India Jain, V.K. 1997. Fundamentals of Plant Physiology. S Chand and Co Ltd. New Delhi India. Kimball J.W. Biology. Addition. Wesley publishing company. Saxena, S.K. 1995. Modern practical in Plant Physiology and Biochemistry. CBS publication and Distribution, New Delhi, India.
		4.3. Absorption of water and ascent of sap	00:30			
		4.4. Mineral absorption and translocation	01:00			
		4.5. Transpiration; mechanism and factors affecting transpiration and Guttation	01:30	4.6. *Lab work:* Study the process of Transpiration by Bell Jar method.	01:00	
		4.7. Photosynthesis; Photosystem I & Photosystem II, C3 and C4 Cycle.	01:00	4.8. Demonstration of photosynthesis pigments by paper Chromatography or TLC	01:00	
		4.9. Role of Plant growth regulators in Agriculture	01:00	4.10. Study the structure and distribution of Stomata in Dicot and Monocot leaves.	01:00	
				4.11. Study the anatomy of C3 and C4 leaves	01:00	
				4.12. Field visit for physiological Crops in plants.	01:00	
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**16:00**	

3.1 Course Syllabus

Semester IV

Credit Hours: 3 [Theory: 1.0; Practical: 2.0]
Teaching Hours: 48:00

Course Code: PLB447
Course Title: Principles of Genetics
Course Description: This course majorly covers theoretical perspectives of cell division, life cycle of some organisms, genetics and function of genes, linkage of genes, Mendelian inheritance pattern, probability for Mendelian genetics, gene action and interactions, inheritance of cytoplasm genes, control and transmission of sex in plants and animals, structure and function of genes, modification of forms of genes.

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

a. the science of genetics in terms of chromosomal characters,
b. genes, gene actions and interactions, and
c. fundamental principles of genetics.

Course contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction to genetics	1.1. Introduction, scope, history, and relation of genetics with other disciplines	1:00			Snustad, D. P., & Simmons, M. J. (2015). *Principles of genetics*. John Wiley & Sons.
II	Cell and Life cycle	2.1. Cell cycle and different stages of mitosis cell division	1:00	2.2. *Group Discussion*: Presentation of different stages of Mitosis cell division.	2:00	Strickberger, M.W. (2012). Genetics (3rd ed.) PHI Learning Pvt. Ltd., New Delhi, India.
		2.3. Different stages of meiosis cell division		2.4. *Group Discussion:* Presentation of different stages of Meiosis cell division.	2:00	
		2.5. Life cycles of Virus, maize, Bacteria, and Man	1:00	2.6. *Group Discussion:* Presentation of life cycle of virus, maize, and bacteria.	2:00	
III	Mendel's law of inheritance	3.1. Law of segregation	1:00	3.2. *Group Work:* Solving numerical problems related to Mendel's law of segregation.	2:00	Strickberger, M.W (2012). Genetics

		3.3. law of independent assortment		3.4. *Group Work:* Solving numerical problems related to Mendel's law of independent assortment.	2:00	(3rd ed.) PHI Learning Pvt. Ltd., New Delhi, India.
IV	Probability and Chi-Square Testing	4.1. Probability and its applications in genetics	1:00	4.2. *Group Practice:* Solving probability related numerical problems.	2:00	Strickberger, M.W. (2012). Genetics (3rd ed.) PHI Learning Pvt. Ltd., New Delhi, India.
		4.3. Chi-Square test and its applications in genetics	1:00	3.3. *Group Practice:* Solving Chi-Square test related numerical problems	2:00	
V	Gene action and interactions	5.1. Inter-allelic or intra-genic gene interaction 5.3. Inter-genic and pleiotropic effect of genes	1:00	5.2. *Group work:* Solving problems related to gene action and interactions	3:00	Snustad, D. P., & Simmons, M. J. (2015). Principles of genetics. John Wiley & Sons.
VI	Linkage and crossing over	6.1. Linkage and crossing over	2:00	6.2. *Problem Solving:* Construction of linkage maps from the given problems.	2:00	Strickberger, M.W. (2012). Genetics (3rd ed.) PHI Learning Pvt. Ltd., New Delhi, India.
VII	Sex linkage and Maternal inheritance	7.1. Mechanisms of sex determination in plants and animals, Sex linked and influencing characters.	1:00	7.2. *Group practice:* Solving numerical problems of sex-linked genes/characters.	2:00	Griffiths, A J.F., S.R. Wessler, S.B. Carroll & Doebley, J. (2012). An introduction to genetic analysis (10th ed.). W.H. Freeman and Company, New York, USA.
		7.3. Maternal effects, cytoplasmic inheritance, male sterility, restorer and non-restorer genes.	1:00	7.4. *Demonstration:* Field demonstration of Cytoplasmic/genetic male sterility	3:00	
VIII	Nucleic acids and gene regulation	8.1. Introduction, structure, and replication of DNA.	1:00	8.2. *Labwork:* Sampling and isolation of DNA from different plants.	2:00	Singh, B.D. (2007). Fundamentals of genetics (3rd Ed.). Kalyani Publishers, India.
		8.3. RNA, its types and transcription,	1:00	8.4. *Field work:* Collection, characterization, emasculation and crossing works in cereal, legume and vegetable crops.	3:00	
		8.5. Translation, genetic code, and gene regulation	1:00			
IX	Mutations and chromosomal	9.1. Concept, characteristics, limitations, and classification of mutation. Mutagens and their classification.	1:00	9.2. *Field work:* Demonstration of cytoplasmic/genetic male sterility in the field condition.	3:00	Strickberger, M.W. (2012). Genetics (3rd ed.) PHI

	aberrations					Learning Pvt. Ltd., New Delhi, India.
		9.3. Structural and numerical changes in chromosomes.	1:00			Snustad, D. P., & Simmons, M. J. (2015). *Principles of genetics*. John Wiley & Sons.
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**32.00**	

3.1 Course Syllabus

Semester V

Course Code: PLB 458 *Credit Hours:* 3 [Theory: 1.0; Practical: 2.0]

Course Title: Principles and practices of plant biotechnology *Teaching Hours*: 48

Course Description: This course majorly covers theoretical perspectives of genetic engineering and its applications, tissue culture and its applications in the field of crop improvement, different types of vectors, restriction endonucleases and their role in genetic engineering, basic knowledge on polymerase chain reaction, gel electrophoresis, and modern day biotechnological tools and technologies.

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

a. The science and scope of plant biotechnology in modern day,
b. modern bio-technological tools and technologies, and
c. fundamental principles of genetic engineering and tissue culture.

Course contents

Introduction to Biotechnology: History, Scope and its application, Plant biotechnology in Nepal: achievements, history, and related organizations; Genetic Engineering: Concept, principles, and methods of genetic engineering in crops, Restriction endonucleases, its types and role in genetic engineering, Vectors, its type and gene cloning, GMOs, and Molecular farming; Tissue Culture: Principles and techniques of tissue culture; cell suspension, callus, and protoplast culture; Culture media preparation/formulation, Anther/pollen, meristem, and embryo culture; . Haploid, and double haploid production; Somatic hybridization and Cybridization: Polymerase chain reaction and gel electrophoresis: Polymerase chain reaction, techniques, and applications, Gel electrophoresis: Modern plant biotechnology; Gene editing and its applications, Molecular markers in crop improvement.

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction to Biotechnology	1.1. Introduction, History, Scope and its application	1:00			Chawla, H. S. (2011). Introduction to plant biotechnology (3/e). CRC Press.
		1.2. Plant biotechnology in Nepal: achievements, history, and related organizations	1:00	1.3. *Learning & Exploring:* Laboratory visit to National Biotechnology, Seed Technology, and Plant Pathology research Center, Khumaltar, Lalitpur, Nepal.	8:00	https://api.giwms.gov.np/storage/75/posts/1685027_376_77.pdf
II	Genetic Engineering	2.1. Concept, principles, and methods of genetic engineering in crops.	2:00	2.2. *Assignment:* Documentation of recent achievements through genetic engineering in Crops.	2:00	Abdin, M. Z., Kiran, U., Kamaluddin, & Ali, A. (Eds.). (2017). Plant Biotechnology: Principles and Applications.
		2.3. Restriction endonucleases, its types and role in genetic engineering	1:00	2.4. *Group presentation*: Presentation of general outlines of genetic engineering in crops.	3:00	Kempken, F., & Jung, C. (Eds.). (2010). Genetic Modification of Plants. Biotechnology in Agriculture and Forestry.
		2.5. Vectors, its type and gene cloning	1:00	2.6. *Lab Work:* Isolation of DNA from different plants and their quantification using software.	3:00	Slater, A., Scott, N., & Fowler, M. (2008). Plant biotechnology: the genetic manipulation of plants. OUP Oxford.
		2.7. GMOs, and Molecular farming	1:00	2.8. *Assignment:* Legislations related to GMOs in Nepal	2:00	
III	Tissue Culture	3.1. Principles and techniques of tissue culture; cell suspension, callus, and protoplast culture	1:00	3.2. *Group Work:* Solving numerical problems related to cultural media formulations.	2:00	Smith, R. H. (2013). *Plant tissue culture: techniques and experiments*. academic press.
		3.3. Culture media preparation/formulation, Anther/pollen, meristem, and embryo culture	2:00	3.4. *Lab work: Culture media preparation for tissue culture.*	3:00	Park, S. (2021). *Plant tissue culture: techniques and experiments*. Academic Press.
		3.5. Haploid, and double haploid production	1:00			
		3.6. Somatic hybridization and Cybridization	1:00			Christou, P., & Klee, H. (Eds.).
	Polymerase	4.1. Polymerase chain reaction, techniques, and applications	1:00	4.2. *Lab work:* Polymerase chain reaction.	3:00	

IV	chain reaction and gel electrophoresis	4.3. Gel electrophoresis	1:00	4.4. *Lab work:* Gel electrophoresis	3:00	(2004). Handbook of plant biotechnology (Vol. 2). Chichester: John Wiley & Sons.
V	Modern plant biotechnology	5.1. Gene editing and its applications	1:00	5.2. *Assignment:* Application and Achievements of gene editing, and molecular marker technology in crops.	3:00	Liu, W., Yuan, J. S., & Stewart Jr, C. N. (2013). Advanced genetic tools for plant biotechnology. Nature Reviews Genetics, 14(11), 781-793.
		5.3. Molecular markers in crop improvement	1:00			
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	32.00	

Semester VI

Course Code: PLB 468 *Credit Hours:* 3 [Theory: 1.0; Practical: 2.0]

Course Title: Principles and practices of Plant Breeding *Teaching Hours*: 48

Course Description: This course introduces plant breeding principles and methods for crop improvement. It covers topics like plant domestication, genetic diversity estimation, pollination control, selection techniques for self- and cross-pollinated crops, hybridization, and mutation breeding. The course also explores crop improvement practices in Nepal through field visits and practical exercises.

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

a. Understand the principles and techniques of plant breeding,
b. apply genetic principles to crop improvement, and
c. explore crop improvement practices in Nepal.

Course contents

Introduction to Plant Breeding: Overview, history, goals, and relationship to other sciences. Germplasm collection, gene pool, and centers of origin. Pollination modes, male sterility, and self-incompatibility; Genetic Selection and Hybridization: Qualitative and quantitative traits, biometrical techniques. Pureline theory, progeny testing, genetic gain, and heritability. Hardy-Weinberg law, hybridization techniques, and selection response; Selection methods for self-pollinated and cross-pollinated crops. Clonal selection in asexually propagated crops; Mutation breeding, polyploidy production, and breeding for disease/pest resistance; Crop Improvement in Nepal: Crop improvement for rice, wheat, maize, legumes, potato, and tomato. Release of new varieties.

IV	chain reaction and gel electrophoresis	4.3. Gel electrophoresis	1:00	4.4. *Lab work:* Gel electrophoresis	3:00	(2004). Handbook of plant biotechnology (Vol. 2). Chichester: John Wiley & Sons.
V	Modern plant biotechnology	5.1. Gene editing and its applications	1:00	5.2. *Assignment:* Application and Achievements of gene editing, and molecular marker technology in crops.	3:00	Liu, W., Yuan, J. S., & Stewart Jr, C. N. (2013). Advanced genetic tools for plant biotechnology. Nature Reviews Genetics, 14(11), 781-793.
		5.3. Molecular markers in crop improvement	1:00			
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	32.00	

Semester VI

Course Code: PLB 468 *Credit Hours:* 3 [Theory: 1.0; Practical: 2.0]

Course Title: Principles and practices of Plant Breeding *Teaching Hours*: 48

Course Description: This course introduces plant breeding principles and methods for crop improvement. It covers topics like plant domestication, genetic diversity estimation, pollination control, selection techniques for self- and cross-pollinated crops, hybridization, and mutation breeding. The course also explores crop improvement practices in Nepal through field visits and practical exercises.

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

a. Understand the principles and techniques of plant breeding,
b. apply genetic principles to crop improvement, and
c. explore crop improvement practices in Nepal.

Course contents

Introduction to Plant Breeding: Overview, history, goals, and relationship to other sciences. Germplasm collection, gene pool, and centers of origin. Pollination modes, male sterility, and self-incompatibility; Genetic Selection and Hybridization: Qualitative and quantitative traits, biometrical techniques. Pureline theory, progeny testing, genetic gain, and heritability. Hardy-Weinberg law, hybridization techniques, and selection response; Selection methods for self-pollinated and cross-pollinated crops. Clonal selection in asexually propagated crops; Mutation breeding, polyploidy production, and breeding for disease/pest resistance; Crop Improvement in Nepal: Crop improvement for rice, wheat, maize, legumes, potato, and tomato. Release of new varieties.

Unit	Macro Level Content	Micro Level Content				References
		Theoretical elements of Teaching	Lecture hours	Practical Learning Elements	Lecture hours	
I	Introduction to Plant Breeding	1.1. Definition, History, Goals, Nature, Objectives, Activities, Achivements and Relation to other sciences	1:00			Plant Breeding and Farmer Participation. (2009). Italy: Food and Agriculture Organization of the United Nations. Plant Mutation Breeding and Biotechnology. (2012). Italy: CABI.
		1.2. Plant Introduction, Domestication and Germplasm Collection, Concept of Gene Pool and Centers of Origin	1:00	1.3. *Field work*: Exploration trip for collecting local germplasm.	2:00	
				1.4. *Group work:* Estimation of Genetic Diversity	2:00	
		1.5. Modes of Pollination and Reproduction, Pollination Control: Male Sterility and Self-incompatibility	1:00	1.6. *Group work:* Study and Draw Floral Parts of Self-pollinated Crops	2:00	
				1.7. *Group work:* Study and Draw Floral Parts of Cross pollinated Crops	2:00	
II	Genetic Selection and Hybridization	2.1. Qualitative and Quantitative Characters, Biometrical techniques in Plant Breeding	1:00	2.2. *Field work*: Plant Breeding Data Recording	2:00	Hussain, A., Arshad, K., Abdullah, J., Aslam, A., Azam, A., Bilal, M., ... & Abdullah, M. (2021). A comprehensive review on breeding technologies and selection methods of self-pollinated and cross-pollinated crops. *Asian Journal of Biotechnology and Genetic Engineering*, *4*(3), 35-47. Khan, A. S., Ali, Z., Shah, K. N., & Khan, A. Introduction to Plant Breeding.
		2.3. Selection in Self Pollinated Crops: Pureline Theory, Progeny Test, Origin of Variation, Genetic gain and Heritability	1:00			
		2.4. Selection in Cross Pollinated Crops: Hardy-Weinberg law and equilibrium, Selection response and Gain from selection in cross pollinated crops	1:00	2.5. *Lab work*: Estimation of heritability and genetic gain from selection	2:00	
		2.6. Hybridization Techniques, Heterosis and Inbreeding	1:00	2.7. *Field work*: Hybrid seed Production using CMS line	3:00	
				2.8. Estimation of Heterosis and Inbreeding Depression	2:00	
III	Breeding Methods in Crops	3.1. Breeding Methods in Self Pollinated Crops: Mass Selection, Pureline Selection and Pedigree Selection	1:00	3.2. *Field Visit*: Visit and study of research activities of National Wheat Research Program	3:00	Hallauer, A. R. (2023). Breeding systems. In *CRC Handbook of Plant Science in Agriculture* (pp. 61-87). CRC Press. Dhulgande, G. S., & Dhale, D. A. (2023). *Basics of Plant breeding and Seed Technology*. Book Saga
		3.2. Breeding Methods in Self Pollinated Crops: Back cross Selection, Bulk Selection and Single Seed Descent Selection	1:00			

		3.3. Breeding Methods in Cross Pollinated Crops: Mass Selection, Progeny Selection, Half-sib and Full-sib selection, Simple recurrent selection	1:00	3.4 *Field Visit*: Visit and study of research activities of National Maize Research Program	3:00	Publications. Bos, I., & Caligari, P. (2007). *Selection methods in plant breeding*. Springer Science & Business Media.
		3.5 Breeding methods in asexually propagated crops: clonal selection	1:00	3.6. *Field Visit*: Visit and study of research activities of National Potato Research Program	3:00	
IV	Mutation and Resistance Breeding	4.1 Definition and Types of Mutagens, Mutation Breeding, Procedures and its Applications	1:00			Sharma, A. K., & Sharma, R. (2014). *Crop improvement and mutation breeding*. Scientific Publishers. Borojević, S. (1990). *Principles and methods of plant breeding*. Walter de Gruyter GmbH & Co KG.
		4.2 Production and applications of Haploid, Aneuploid, Autotriploids, Autotetraploids, Alloploids, Evolution of Wheat, Brassica and Triticale.	1:00			
		4.3 Breeding for disease and Insect Resistance	1:00	4.4. *Group practice*: Scoring data and determining resistance/ susceptibility of pests	2:00	
V	Crop Improvement in Nepal	5.1. Crop improvement of some important crops in Nepal: Rice, Wheat, Maize, Legumes, Potato and Tomato.	1:00	5.2. *Participatory Plant Breeding*: Visit and record the plant breeding activities of a given farmer	2:00	Santhoshini, R. T., Kumar, R., Dubey, N., Avinashe, H. A., Puri, P., Singh, S., & Yadav, A. N. (2025). Advancing in orphan crops through innovative breeding methods and genomic approaches: Current research and future challenges. *Journal of Applied Biology & Biotechnology Vol, 13*(2), 9-19. Mengistu, B. (2017). Nepal Seed and Fertilizer Project: annual report year I.
		5.3. Release of a New Variety (Evaluation, Identification and Release)	1:00	5.6. *Group discussion*: Describing the traits for releasing a new variety	2:00	
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	32:00	

Graduate School of Agriculture and Forestry
Birendranagar, Surkhet
Syllabus of Introduction to Soil Science

3.1 Course Syllabus

Semester I

Course Code: SSC417 *Credit Hours:* 2 [Theory: 1; Practical: 1]
Course Title: Introduction to Soil Science *Teaching Hours:* 32

Course Description: This course provides foundational knowledge of soil science, focusing on soil properties, formation, and its role in crop production.

Course Objectives: The general objective of this course is to provide students with foundational knowledge of soil science. Specifically, the course aims to –

a. To understand the basic properties and functions of soil in relation to crop production,
b. to learn the processes of soil formation and the role of rocks and minerals, and
c. to develop practical skills for soil sampling, analysis and interpretation.

SYLLABUS

Introduction and history of soil: Pedology and Edaphology, Historical development of Soil Science, Concept and definition of soil, Components of soil, Soil as a natural dynamic body and medium for plant growth, Physical properties: Soil Texture, Soil Structure, Soil Color, Soil Bulk Density, Soil Particle Density, Porosity, Relationship among Db, Dp and Porosity, Chemical properties: Soil reaction: Soil acidity, Alkalinity and their management practices, Weathering of rocks and minerals: Definition, types of weathering- physical, chemical & biological weathering with examples, Physiographic units of Soil: Tropical, Subtropical, Temperate, Alpine, Different organization involved on soil science in Nepal, Important rocks and minerals of Karnali Province.

Unit	Macro Level Contents	Micro Level Contents				Reference
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Introduction and history of soil	1.1 Pedology and Edaphology, Historical development of Soil Science	2:00	-		Dilip Kumar Das. 2011. Introductory Soil Science (3rd revised and Enlarging Edition). Kalyani Publishres. New Delhi. Satya Narayan Mandal. 2013. Brief Introduction to Soil. Department of Agriculture, Lalitpur, Nepal
		1.2 Concept and definition of soil, Components of soil	1:00	1.3. *Lab Visit*: Identification of laboratory equipment for soil science	1:00	
		1.4 Soil as a natural dynamic body and medium for plant growth	1:00	1.5. *Field Work*: Soil and plant sampling and their preparation for future analysis	1:00	
II	Physical properties	2.1. Soil Texture, Soil Structure, Soil Color, Soil mottles	2:00	2.2. *Lab work*: Texture determination by hydrometer method and interpret the data to determine soil type using textural triangle	1:00	Nyle C. Brady and Ray R. Weil. 2017. The nature and Properties of Soils (14th Edition). Pearson India Education Services Pvt. Ltd. Robert E. White. 2006. Principles and Practices of Soil Science: The Soil as a natural Resources. Backwell Publication, USA.
				2.3. *Filed work*: Determination of soil structure and observe mottles in the field at Ramghat Surkhet	1:00	
				2.4. *Lab work*: Soil consistency, plasticity and texture determination by feel method	2:00	
				2.5. *Lab work*: Determination of soil color by visual observation and Munshell color chart	1:00	
		2.6. Soil Bulk Density, Soil Particle Density, Porosity	2:00	2.7. *Lab work*: Soil Db determination by using core sampler or pipe ring	2:00	
				2.8. *Lab work*: Determination of Dp using Pycnometer	2:00	
		2.9. Relationship among Db, Dp and Porosity	0.5	2.10. *Group work*: Calculation of porosity, bulk density and particle density using missing data	1:00	
II	Chemical properties,	3.1. Soil reaction: Soil acidity, Alkalinity and their management	2.5	3.2. *Lab work*: Determination of soil pH of different cropping patterns	2:00	Nyle C. Brady and Ray R. Weil.

I	Weathering of rocks and minerals	practices		and interpret in relation with nutrient availability		2017. The nature and Properties of Soils (14th Edition). Pearson India Education Services Pvt. Ltd. . S. G. Rajput. 2012. Concept of Soil Science. Kalyani Publishres. New Delhi. .
		3.3. Definition, types of weathering-physical, chemical & biological weathering with examples.	2:00			
		3.4. Important rocks and minerals found in Karnali Province	1:00	3.5. *Group discussion*: Identification of soil forming rocks and mineral of Karnali Province	1:00	
IV	Physiographic units of Soil	4.1. Tropical, Subtropical, Temperate, Alpine	1:00			Satya Narayan Mandal. 2013. Brief Introduction to Soil. Department of Agriculture, Lalitpur, Nepal.
		4.2. Different organization involved on soil related activities in Nepal	1:00	4.3. *Project work*: Report preparation using soil analysis data and NARC standards	1:00	
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**16:00**	

Graduate School of Agriculture and Forestry

Birendranagar, Surkhet

Syllabus of Soil Fertility and Nutrient Management

3.1 Course Syllabus

Semester II

Course Code: SSC425 *Credit Hours:* 3 [Theory: 1; Practical: 2]

Course Title: Soil Fertility and Nutrient Management *Teaching Hours:* 48

Course Description: Upon completion of this course, students will be able to understand the relationship between soil fertility, inorganic and organic fertilizers and the role of organic and bio fertilizers in soil health and crop production.

Course Objectives: The general objective of this course is to provide students with a comprehensive understanding of soil fertility and nutrient management. Specifically, this course aims to-

a. Familiarize students with the concepts of soil fertility and nutrient management for better crop production,
b. promote the importance of maintaining soil health through the use of organic nutrient sources, and
c. provide a deep understanding of the role of essential plant nutrients in enhancing crop productivity.

Syllabus

History and Basics of Soil Fertility and Plant Nutrition: Historical development of soil fertility and nutrition management, Criteria for nutrient essentiality, Classification of essential nutrients: macro, secondary and micro-nutrients, Plant-available forms of nutrients, Liebig's Law of Minimum and its application in nutrient management, Nutrient use efficiency concepts, Plant Nutrients and their dynamics: Nitrogen (N): Sources, functions in plant metabolism, deficiency symptoms and effects on crop production, Negative impacts of nitrogen misuse (eutrophication, nitrate leaching, blue baby syndrome, soil acidification), Phosphorus (P): Sources, role in energy transfer and deficiency symptoms, Phosphorus fixation and strategies to improve availability in Nepalese soils, Potassium (K): Sources, role and luxury consumption effects, Secondary Nutrients (Ca, Mg, S): Sources, functions, and deficiency symptoms, Micronutrients (B, Zn, Mo, Fe, Mn, Cu): Functions, toxicity, and management strategies, Cation Exchange Capacity (CEC): Definition, significance and mechanisms of negative charge development in different soil colloids, Anion Exchange Capacity (AEC): Importance in tropical soils and nutrient retention, Soil buffering capacity and its role in nutrient availability and pH regulation, Organic and Sustainable Nutrient Management: Preparation and benefits of organic manures, Vermicompost Production: Process, materials, and application, Bio-fertilizers: Types (Rhizobium, Azotobacter, phosphate-solubilizing bacteria), application techniques, and benefits, Biological Nitrogen Fixation (BNF) under Nepalese climatic conditions, Nutrient mineralization and immobilization in organic systems, Integrated nutrient management (INM) for sustainable agriculture, Use of goat dropping, poultry litters, pig manure, biogas slurry, dis-infected night soil, FYM, animal urine and crop residue recycling for high land rice (Jumli Marshi) Production, Sustainable Agriculture and Nutrient Use in Climate-Resilient: Principles of sustainable agriculture and nutrient recycling,

Environmental and economic sustainability of nutrient use efficiency, Role of organic fertilizers and INM in carbon sequestration and climate resilience, Practices for moisture conservation and organic matter management in different agro ecological zones of Nepal, Assessment of nutrient management strategies for mitigating soil degradation and enhancing crop productivity, Future trends in nutrient management and the role of digital tools in agriculture.

Unit	Macro Level Contents	Micro Level Contents				Reference
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	History and Basics of Soil Fertility and Plant Nutrition	1.1 Historical development of soil fertility and nutrition management	1:00	1.2. *Field work:* Soil Sampling Techniques for Nutrient Analysis	1:00	Roy, R. N. (2006). *Plant nutrition for food security: A guide for integrated nutrient management.* Food and Agriculture Organization of the United Nations. Havlin, J. L., Beaton, J. D., Tisdale, S. L., & Nelson, W. L. (2005). *Soil fertility and fertilizers: An introduction to nutrient management* (7th ed.). Pearson.
		1.3. Criteria for nutrient essentiality	1:00	1.4. *Lab work*: Determination of Bulk Density Using the Core Ring Method	1:00	
		1.5. Classification of essential nutrients: macro, secondary and micro-nutrients		1.6. *Lab work:* Soil Organic Carbon Estimation: Ignition and Walkley -Black Methods	2:00	
		1.7. Plant-available forms of nutrients				
		1.8. Liebig's Law of Minimum and its application in nutrient management.	1:00			
		1.9. Nutrient use efficiency concepts		1.10. *Calculation:* Calculation of Nutrient Use Efficiency from Field or Experimental Data	1:00	
II	Plant Nutrients and their dynamics	2.1. Nitrogen (N): Sources, functions in plant metabolism, deficiency symptoms and effects on crop production	1:00	2.2. *Lab work:* Nitrogen Analysis Using the Kjeldahl Method	2:00	Brady, N. C., & Weil, R. R. (2017). *The nature and properties of soils* (14th ed.). Prentice Hall, Inc. Tisdale, S. L., Nelson, W. L., Beaton, J. D., & Havlin, J. L. (1993). *Soil fertility and fertilizers* (5th ed., P. F. Corey, Ed.). Macmillan Publishing Co. Marschner, H. (2012). *Marschner's mineral nutrition of higher plants* (3rd ed.). Academic Press.
		2.3. Negative impacts of nitrogen misuse (eutrophication, nitrate leaching, blue baby syndrome, soil acidification)		2.4. *Filed work*: Observation of Deficiency Symptoms via the Omission Pot Method (NPK in maize crops, N and +N, -P and +P, -K and +K, -B and +B on cauliflower and wheat)	2*3=6	
		2.5. Phosphorus (P): Sources, role in energy transfer and deficiency symptoms	1:00	2.6. *Lab work:* Phosphorus determination using the Modified Olson Method	2:00	
		2.7. Phosphorus fixation and strategies to improve availability in Nepalese soils.		2.8. *Lab work:* On-Site Nutrient Analysis Using Soil Test Kits	2:00	
		2.9. Potassium (K): Sources, role and luxury consumption effects		2.10. *Lab work:* Potassium determination using the Flame Photometer Method	2:00	
		2.11. Secondary Nutrients (Ca, Mg, S): Sources, functions, and deficiency symptoms.	1:00	2.12. *Project work*: Field-Based Visual Diagnosis of Nutrient Deficiency Symptoms	2:00	
		2.13. Micronutrients (B, Zn, Mo, Fe, Mn, Cu): Functions, toxicity, and management strategies.	1:00	2.14. *Lab work:* B determination Using Hot water bag method	2:00	
		2.15. Cation Exchange Capacity (CEC):	1:00	2.16. *Lab work:* Determine soil CEC in local soils using	2:00	

		Definition, significance and mechanisms of negative charge development in different soil colloids.		laboratory techniques.		
		2.17. Anion Exchange Capacity (AEC): Importance in tropical soils and nutrient retention.	1:00			
		2.18. Soil buffering capacity and its role in nutrient availability and pH regulation.		2.19. *Lab work:* Soil pH Measurement and Interpretation	1:00	
III	Organic and Sustainable Nutrient Management	3.1. Preparation and benefits of organic manures	1:00	3.2. *Filed work*: Compost Production and Quality Evaluation	2:00	White, R. E. (2009). *Principles and practice of soil science: The soil as a natural resource* (4th ed.). Blackwell Publishing Co. Fageria, N. K. (2013). *The use of nutrients in crop plants*. CRC Press.
		3.3. Vermicompost Production: Process, materials, and application.		3.4. *Field work*: Vermicomposting with Local Resources: Techniques and Quality Assessment	2:00	
		3.5. Bio-fertilizers: Types (Rhizobium, Azotobacter, phosphate-solubilizing bacteria), application techniques, and benefits.	1:00			
		3.6. Biological Nitrogen Fixation (BNF) under Nepalese climatic conditions.	1:00			
		3.7. Nutrient mineralization and immobilization in organic systems.				
		3.8. Integrated nutrient management (INM) for sustainable agriculture	1:00			
		3.9. Use of goat dropping, poultry litters, pig manure, biogas slurry, dis-infected night soil, FYM, animal urine and crop residue recycling for high land rice (Jumli Marshi) Production		3.10. *Farm visit*: Utilization of Biogas Slurry: Conservation and Application Techniques	1:00	
IV	Sustainable Agriculture and Nutrient Use in Climate-Resilient Systems	4.1. Principles of sustainable agriculture and nutrient recycling.	1:00			Lal, R. (2020). *Soil and sustainable agriculture*. CRC Press. Uphoff, N., Kassam, A., & Thakur, A. K. (Eds.). (2018). *Advances in sustainable agriculture systems*. Springer.
		4.2. Environmental and economic sustainability of nutrient use efficiency.				
		4.3. Role of organic fertilizers and INM in carbon sequestration and climate resilience.	1:00			
		4.4. Practices for moisture conservation and organic matter management in different agro ecological zones of Nepal.				
		4.5. Assessment of nutrient management strategies for mitigating soil degradation and enhancing crop productivity.	1:00			
		4.6. Future trends in nutrient management and the role of digital tools in agriculture.		4.7. *Group Presentation*: Preparation of Presentations on Innovative Nutrient Management Technologies	1:00	
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**32:00**	

Graduate School of Agriculture and Forestry

Birendranagar, Surkhet

Syllabus of Soil Physics, Genesis and Classification

3.1 Course Syllabus

Semester III

Course Code: SSC436 *Credit Hours:* 2 [Theory: 1; Practical: 1]

Course Title: Soil Physics, Genesis and Classification *Teaching Hours:* 32

Course Description: This course focuses on studying the properties and characteristics, with an emphasis on soil physics, soil forming process, weathering and the establishment of soil classification system.

Course Objectives: The general objective of this course is to provide students with a comprehensive understanding of soil physics and classification. Especially, this course aims to-

a. Impart among the learners fundamental concepts related to soil moisture, water movement, air and heat movement in soil,
b. familiarize with different soil horizons, and
c. introduce various soil classification systems, soil mapping, and interpretation.

SYLLABUS

Basic Concepts of Soil Physics: Energy concept and Quantative concept of soil physics, Soil moisture characteristics and soil moisture potential, Soil water flow: saturated, unsaturated and vapour form, Air and heat movement in soil and infiltration characteristics of soil, Soil Forming Factors and Process: Soil forming Process, Factors affecting soil formation, Soil Profile and its Horizon: Soil profile, diagnostic horizon and designation, Surface and subsurface diagnostic horizon, Soil moisture and temperature regimes, Soil Classification: History of soil classification, modern soil classification system in Nepal, Criteria and nomenclature for USDA system of soil classification, Comparison of FAO / UNESCO system of soil classification, Major soil types of Nepal.

Unit	Macro Level Contents	Micro Level Contents				Reference
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Basic Concepts of Soil Physics	1.1.Energy concept and Quantative concept of soil physics	2:00	1.2. *Lab work:* Determination of soil water content by weight (gravimetric method)	2:00	Brady, N. C., & Weil, R. R. (2017). The nature and properties of soil (14th ed.). Pearson Education Inc. Jaiswal, P. (2013). Soil, plant and water analysis. New Delhi: Kalyani Publishers.
		1.3. Soil moisture characteristics and soil moisture potential	1:00			
		1.5. Soil water flow: saturated, unsaturated and vapour form	1:00	1.6. *Micro-presentations:* Study of Tentiometer	2:00	
		1.7. Air and heat movement in soil and infiltration characteristics of soil	1:00	1.8. *Lab work:* Determination of saturated Hydraulic Conductivity of soil.	2:00	
				.		
				1.10. Lab work: Determination of infiltration rate by double ring method	2:00	
II	Soil Forming Factors and Process	2.1. Soil forming Process	2:00	2.3. *Micro presentations:* Collection and Identification of soil forming rocks and mineral of Karnali Province	2:00	Brady, N. C., & Weil, R. R. (2017). The nature and properties of soil (14th ed.). Pearson Education Inc. Mandal, S. N. (2013). Brief Introduction to Soil. Lalitpur, Nepal: Department of Agriculture.
		2.2 Factors affecting soil formation	1:00			
III	Soil Profile and its Horizon	3.1 Soil profile, diagnostic horizon and designation.	2:00	3.2. *Group practice:* Soil profile description and horizon identification	3:00	Soil Survey Staff. (1999). Soil Taxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys. Washington, DC: U.S. Government Printing Office.
		3.3 Surface and subsurface diagnostic horizon	1:00			
		3.4 Soil moisture and temperature regimes	1:00			
IV	Soil Classification	4.1 History of soil classification, modern soil classification system in Nepal	1:00	4.2. *Group Discussions*: Determination of soil properties of epipedon and soil classification	2:00	Soil Survey Staff. (1999). Soil Taxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys. Washington, DC: U.S. Government Printing Office. Brady, N. C., & Weil, R. R. (2017). The nature and properties of soil (14th ed.). Pearson Education Inc. Buol, S. W., Hole, F. D., McCracken, R. J., & Southard, R. J. (2011). Soil Genesis and Classification (6th ed.). Iowa State University Press.
		4.3. Criteria and nomenclature for USDA system of soil classification	1:00			
		4.4. Comparison of FAO / UNESCO system of soil classification	1:00	4.5. *Project Work:* : Land capability classification of classified soil/land	1:00	
		4.6. Major soil types of Nepal	1:00			
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	16:00	

Graduate School of Agriculture and Forestry

Birendranagar, Surkhet

Syllabus of Irrigation Management

3.1 Course Syllabus

Semester V

Course Code: SSC455 *Credit Hours:* 3 [Theory: 1; Practical: 2]

Course Title: Irrigation and Water Management *Teaching Hours:* 48

Course Description: This course focuses on the properties and characteristics of irrigation management in agriculture field, exploring irrigation methods, soil-water-plant relationships, and crop water requirements with irrigation scheduling and sustainable practices.

Course Objectives: The general objective of this course is to provide students with a comprehensive understanding of irrigation management in agriculture field. Especially, this course aims to -

a. Provide knowledge about the development and significance of irrigation in agriculture,
b. understand crop water requirements and methods to enhance water use efficiency and,
c. explore various farm irrigation practices and sustainable techniques.

SYLLABUS

Definition, significance, and objectives of irrigation, Importance in agriculture: Impact on crop production and economic benefits, Irrigation in Nepal: Current status, challenges, opportunities and impact of climate change, Overview of irrigation projects, Government policies and initiatives. Soil Water Dynamics: Soil water potential and its components, forms, occurrence, and classification of soil water, Infiltration, its types and factors affecting infiltration capacities, Soil moisture behaviour and Soil moisture constants, Plant Water Uptake: Root absorption process, Transpiration and its role in water movement in a plant body. Consumptive use and measurement methods: Penman-Montheith equation, crop coefficient (Kc), Crop Water Requirements and methods: critical stages of crop method, farmers method for irrigation scheduling, depth-interval-yield method, soil moisture depletion method and field experiment method, Deficit irrigation strategies: Methods and benefits of deficit irrigation, Duty and Delta of irrigation, Methods to minimize ET, Role of mulching and shading to improve water use efficiency. Methods of irrigation system: Overview of different systems used in Nepal, Innovative Irrigation Practices: Use of sensors and automation, Role of precision agriculture, Sustainable Irrigation Practices: Water conservation techniques, integrated water resource management, Field water measurement methods and devices.

Unit	Macro Level Contents	Micro Level Contents				
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	Reference
I	Introduction of Irrigation	1.1. Definition, significance, and objectives of irrigation	1:00			Michael, A.M. (1997). Irrigation theory and Practices. Vikas publicing house, Pvt.Ltd., New Delhi. Dean, E., Martin, D. L., Heeren, D. M., & Hoffman, G. J. (2021). Chapter 1: Introduction to irrigation. In Irrigation system management (pp. 1-9). St. Joseph, MI: ASABE. Society of Agriculture and Biological Engineers. https://doi.org/10.13031/ISM.2021.1
		1.2. Importance of irrigation in agriculture: Impact on crop production and economic benefits	1:00	1.3. *Field work*: Surveying and mapping irrigation systems in local farms	2:00	
		1.4. Irrigation in Nepal: Current status, challenges, opportunities and impact of climate change	1:00	1.5. *Group work:* Visit to nearest farmer's irrigation facilitated farms and interaction with farmers about irrigation to submit report	2:00	
		1.6. Overview of irrigation projects, Government policies and initiatives	1:00	1.7. *Field Visit*: Visit to an irrigation project and familiar with different irrigation structures	2:00	
II	Soil Water Plant Relationship	2.1. Soil Water Dynamics: Soil water potential, forms and classification	1:00	2.2. *Lab work*: Pot experiment on soil water retention capacities with different soil types— coarse, medium and fine textured soil	2:00	Manandhar, B.D. (2022). Laboratory manual principles and practices of farm water Irrigation management, pub. Maitreya Agri Engineering Industry, Chitwan,Nepal, 95p. Kirkham, M. B. (2023). *Principles of soil and plant water relations* (3rd ed.). Academic Press. Chavarria, G., & Santos, H.P. (2012). Plant Water Relations: Absorption, Transport and Control Mechanisms. Behzad, H. M., Arif, M., Duan, S., Kavousi, A., Cao, M., Liu, J., & Jiang, Y. (2023). Seasonal variations in water uptake and transpiration for plants in a karst critical zone in China. *Science of The Total Environment*, *860*, 160424.
		2.3. Infiltration process: Types and influencing factors	1:00	2.4. *Field experiment:* Determination of infiltration capacity by using double ring infiltrometer	2:00	
		2.5. Soil moisture behaviour: Soil moisture constants and retention	1:00	2.6. *Lab work*: Field measurement of soil moisture by using soil moisture meter	1:00	
				2.7. *Lab work*: Determination field capacity (FC) of soil	2:00	
				2.8. *Field experiment:* Determination of soil moisture by using feel and appearance method	2:00	
		2.9. Plant Water Uptake: Root absorption process, Transpiration and its role in water movement in a plant body	1:00	2.10. *Field work*: Measurement of canopy temperature	2:00	
III	Crop Water Requirement	3.1. Consumptive use and measurement methods : Penman-Montheith equation, crop coefficient (Kc)	1:00	3.2. *Calculation:* Determination of ET by using Penman method	1:00	Michael, A.M. (1997). Irrigation theory and Practices. Vikas publicing house, Pvt.Ltd., New Delhi. Sabzevari, Y., & Eslamian, S. (2023). Reference evapotranspiration in water requirement: Theory, concepts, and methods of estimation. In *Handbook of Hydroinformatics* (pp. 269-289). Elsevier. Allen, R. G., Pereira, L. S., Raes, D., & Smith, M. (1998). *Crop evapotranspiration: Guidelines for computing crop water requirements* (FAO Irrigation and drainage paper 56). Food and Agriculture Organization of the United Nations. Food and Agriculture Organization of the United Nations. (2002). *Water reports 22: Deficit irrigation practices*. Rome. ISSN 1020-
		3.3. Methods to minimize ET: Role of mulching, shading and water use efficiency	1:00	3.4. *Lab work*: Determination of Specific gravity of soil	1:00	
		3.5. Irrigation scheduling methods and techniques (critical stages of crop for soil moisture, farmers method for irrigation scheduling and criteria, depth-interval-yield method, soil moisture depletion method and field experiment method)	1:00	3.6. *Project work*: Developing and presenting an irrigation scheduling management plan for a specific crop	2:00	
		3.7. Deficit irrigation strategies: Methods and benefits of deficit irrigation, Duty and Delta of irrigation	1:00			

						1203.
IV	Farm Irrigation Practices	4.1. Irrigation system: Overview of different systems used in Nepal	1:00	4.2.*Field Visit:* Study and design of surface irrigations methods and evaluation	2:00	Punmia, B.C. (1990) Irrigation and water power engineering (11th ed.) Standard publicers house, India. Ayars, J. E., Zaccaria, D., & Bali, K. M. (Eds.). (2023). *Micro irrigation for crop production: design, operation, and management.* Elsevier. Pokharel, A. (2024). *Beyond Collective Action Problems: Perceived Fairness and Sustained Cooperation in Farmer Managed Irrigation Systems in Nepal.* Oxford University Press. Saleem, M., Raza, A., Sabir, R. M., Safdar, M., Faheem, M., Hussain, S., & Al Ansari, M. S. (2024). Applications of sensors in precision agriculture for a sustainable future. *Agriculture and Aquaculture Applications of Biosensors and Bioelectronics* (Chapter 6). https://doi.org/10.4018/979-8-3693-2069-3.ch006 Government of Nepal, Ministry of Energy, Water Resources & Irrigation, Department of Irrigation, Irrigation and Water Resources Management Project. (2018). *Irrigation and Water Resources Management Project (IWRMP) project completion report (2008-2018).* Office of Project Director, Irrigation & Water Resources Management Project, Department of Irrigation. ई . भगवान दास मानन्धर (इस २०१४) नया सिंचाइ प्र विधि र क ृ षर । डिस्क ृ ट सिंचाइ प्र विधि, स्थापितरी सिंचाइ प्र णाली तथा यस् उदे श्यम मै वे य क ृ षरी), प्र . मै वे य मू सि इन्स्टीच्यूटद्र उपो ग, चितवन,४८ पृ ।
		4.3. Innovative Irrigation Practices: Use of sensors/automation and role of precision agriculture	1:00	4.4.*Group discussion*: Study and design of Drip irrigation system and components	2:00	
				4.5. *Field experiment:* Study and design of Sprinkler Irrigation system and components	2:00	
				4.6.*Group discussion*: Newly developed irrigation methods and evaluation	1:00	
		4.7. Sustainable Irrigation Practices: Water conservation techniques, Integrated System for Water Use	1:00	4.8.*Field work*: Fertigation through different fertigation devices	2:00	
				4.9. *Group discussion*: Study of different techniques in rain water harvesting	2:00	
		4.10. Field water measurement methods and devices	1:00	4.11.*Lab work*: Determination of soil moisture content by using a Tenstiometer	2:00	
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**32:00**	

Graduate School of Agriculture and Forestry

Birendranagar, Surkhet

Syllabus of Soil Conservation and Watershed Management

3.1 Course Syllabus

Semester VI

Course Code: SSC464 *Credit Hours:* 2 [Theory: 1; Practical: 1]

Course Title: Soil Conservation and Watershed Management *Teaching Hours:* 32

Course Description: This course provides a knowledge in principles and practices of soil conservation and watershed management, acts and policies of watershed management present in Nepal.

Course Objectives: The general objective of this course is to provide students with a comprehensive understanding of soil conservation and watershed management principles and practices. Especially, this course aims to-

a. Understanding of the fundamental principles of soil conservation and watershed management,
b. develop practical skills in implementing soil conservation and watershed management, and
c. critically review national policies, strategies and practices of soil conservation and watershed management in Nepal and Karnali Province.

SYLLABUS

Soil Erosion: Definitions and types of soil erosion, Causes of soil erosion, Soil Erosion By Water: Mechanism, types and Factors affecting, Soil Erosion by Wind: Mechanism, Types and Factors affecting, Consequences of soil erosion: Fertility loss and land degradation, Floods, landslide and natural hazards, Onsite and offsite consequences, socio economic consequences, Soil erosion estimation and conservation Measures: Estimation methods: Visual methods, Universal Soil Loss Equation (USLE), and modified USLE, Agronomic Measures: Manuring and fertilization, Mulching, Conservation tillage, strip planting, cover crops, contour farming, Agro-Forestry, Grassland Farming, Controlled grazing, Sloping Land Agricultural Technology (SALT), Land management Measures: Land management measures: Terracing, bunding, land capability classification, Bio-engineering: Fascines, Palisades, Wattling, Bamboo Planting, Grass Planting, Live Fencing, Bush layering, Waterways, Structural Measures: Check dams, Gully Control, Stream- Bank Erosion Control Structures, Roadside Erosion Control Structures, Watershed Management: Concepts, Importance, Policies, and Practices in Nepal: Definition, objectives, and importance of watershed management, Causes and consequences of watershed deterioration in Nepal, National policies and plans for soil and watershed management in Nepal, Indigenous and modern watershed management practices, Role of NGOs, INGOs, and government in watershed management, Impacts of climate change on soil and watershed management, Watershed management practices in Karnali Province and Nepal.

Unit	Macro Level Contents	Micro Level Contents				Reference
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Lecture Hours	
I	Soil Erosion	1.1. Definitions and types of soil erosion, Causes of soil erosion	1:00	1.2.*Field visit :* Field visit to erosion-prone areas for watershed boundary mapping	1:00	Morgan, R. P. C. (2009). *Soil erosion and conservation.* John Wiley & Sons. Blanco-Canqui, H., Lal, R. (2008). Principles of Soil Conservation and Management. Germany: Springer Netherlands.
		1.3. Soil Erosion By Water: Mechanism, types and Factors affecting	1:00	1.4.*Field work:* Demonstration of water erosion using a rainfall simulator	1:00	
		1.5. Soil Erosion by Wind: Mechanism, Types and Factors affecting	1:00			
		1.6. Consequences of soil erosion: Fertility loss and land degradation, Floods, landslide and natural hazards, Onsite and offsite consequences, socio economic consequences	1:00	1.7.*Project Work*: Mapping erosion impacts and analyzing onsite/offsite consequences	1:00	
II	Soil erosion estimation and conservation Measures	2.1. Estimation methods: Visual methods, Universal Soil Loss Equation (USLE), and modified USLE	1:00	2.2.*Calculation*: Estimate soil loss using USLE method	1:00	Morgan, R. P. C. (2009). *Soil erosion and conservation.* John Wiley & Sons. Renard, K. G., Lane, L. J., Foster, G. R., & Laflen, J. M. (2023). Soil loss estimation. In *Soil erosion, conservation, and rehabilitation* (pp. 169-202). CRC Press.
		2.3. Agronomic Measures: Manuring and fertilization, Mulching, Conservation tillage, strip planting, cover crops, contour farming, Agro-Forestry, Grassland Farming, Controlled grazing, Sloping Land Agricultural Technology (SALT)	1:00	2.4.*Field visit:* Contour farming demonstration using an A-frame	1:00	Hicks, D. H. (2015). *Soil conservation technical handbook.* Scientific Publishers. Mishra, A., & Mal, B. C. (1955). *Soil and water conservation engineering.* Agrimoon. com. http://ecoursesonline. iasri. res. in/mod/page/view. php. Timilsena, E. N. (2023). Bioengineering Techniques for Roadside Slope Stabilization in Nepal.
		2.5. Land management Measures: Land management measures: Terracing, bunding, land capability classification	1:00	2.6. *Field Work:* Determine soil loss depth under terraced and slope lands in one year monsoon period and reporting	1:00	
		2.7. Bio-engineering: Fascines, Palisades, Wattling, Bamboo Planting, Grass Planting, Live Fencing, Bush layering, Waterways	1:00	2.8. *Field Visit*: Demonstration of bioengineering techniques	1:00	
		2.9. Structural Measures: Check dams, Gully Control, Stream- Bank Erosion Control Structures, Roadside Erosion Control Structures	1:00	2.10. *Field visit*: Evaluate the effectiveness of watershed management	1:00	
III	Watershed Management : Concepts, Importance,	3.1. Definition, objectives, and importance of watershed management	1:00	3.2. *Field work*: Characterization of a local watershed in Karnali Province	1:00	Das, M. M., & Saikia, M. D. (2012). *Watershed management.* PHI Learning Pvt. Ltd..
		3.3. Causes and consequences of watershed deterioration in Nepal	1:00	3.4.*Project work*: Field assessment of watersheds degradation and its effects on	1:00	

	Policies, and Practices in Nepal			socio-economic life of people		Singh, S. L., Kharel, B. P., Joshi, M. D., & Mathema, P. (2004). *Watershed management case study: Nepal: Review and assessment of watershed management strategies and approaches.* Soil and Water Conservation Society (SOWCAS). Nepal, Food and Agriculture Organization of the United Nations.
		3.5. National policies and plans for soil and watershed management in Nepal	1:00	3.6.*Critical review*: National policies on watershed management	1:00	
		3.7. Indigenous and modern watershed management practices	1:00	3.8. *Field visit*: Identify indigenous and present practices of watershed management with effects	1:00	
		3.9. Role of NGOs, INGOs, and government in watershed management	1:00	3.10.*Group discussion*: on the role of stakeholders in watershed management	1:00	
		3.11. Impacts of climate change on soil and watershed management	1:00	3.12.*Case study analysis*: Climate change impacts on watershed management	1:00	
		3.13. Watershed management practices in Karnali Province and Nepal	1:00	3.14.*Group work*: Developing a small-scale watershed management plan	2:00	
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**16:00**	

Graduate School of Agriculture and Forestry
Birendranagar, Surkhet
Syllabus of GIS and Remote Sensing

3.1 Course Syllabus

Semester VII

Course Code: SSC473 *Credit Hours:* 2 [Theory: 1; Practical: 1]

Course Title: GIS and Remote Sensing *Teaching Hours*: 32

Course Description: This course focuses on studying the fundamentals and applications of Geographic Information Systems (GIS) and Remote Sensing (RS) in various fields, with a special emphasis on agriculture.

Course Objectives: The general objective of this course is to provide students with a comprehensive understanding of GIS and RS principles, techniques, and their practical applications. Especially, this course aims to-

a. Equip students with the knowledge of GIS features, functions, and their historical development,
b. apply GIS and RS technologies to solve real-world agricultural problems, and
c. develop practical skills in collecting, processing, and analyzing spatial data using GIS and RS tools.

SYLLABUS

Introduction: Definition of GIS features and Functions, Importance, scope and Historical development of GIS, application of GIS in Agriculture, GIS as an Information system, GIS and cartography, Map Projections and Coordinate Systems; characteristics of maps, Automated cartography versus GIS; precision and error, Data Input and Data Quality, Major data feeds to GIS and their characteristics; maps, GPS, images, Locating and evaluating data; data formats; metadata, Definition, History and Evolution of Remote Sensing, Remote sensing as an Art or Science, Advantages of Remote sensing, limitation of Remote sensing, Ideal and Real Remote sensing, Concept of remote sensing and its Applications in agriculture.

Unit	Macro Level Contents	Micro Level Contents			Lecture Hours	Reference
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning		
I	Introduction	1.1. Definition of GIS features and Functions, Importance, scope and Historical development of GIS, application of GIS in Agriculture	2:00			Principles of Geographic Information Systems: An Introductory Textbook. (2004). Netherlands: International

		1.2. GIS as an Information system, GIS and cartography	1:00	1.3. *Lab work*: Creating a GIS-based information system for a local agricultural community.	2:00	Institute for Geo-Information Science and Earth Observation. Bernhardsen, T. (2002). *Geographic information systems: an introduction*. John Wiley & Sons.
II	GIS and MAPS	2.1. Map Projections and Coordinate Systems; characteristics of maps	2:00	2.2. *Lab work*: Establishments of photo coordinates and their measurements	2:00	Harvey, F. (2015). *A primer of GIS: Fundamental geographic and cartographic concepts*. Guilford Publications. Crampton, J. W. (2011). *Mapping: A critical introduction to cartography and GIS*. John Wiley & Sons.
		2.3. Automated cartography versus GIS; precision and error	2:00	2.4. *Group · Discussion*: Comparison of different map projections and their impact on agricultural mapping	2:00	
III	Data Sources	3.1. Data Input and Data Quality	2:00	3.2. *Group practice:* Familiarization and Interpretation with aerial photographs and satellite images	2:00	Goodchild, M. F. (2010). *Fundamentals of spatial data quality* (Vol. 662). John Wiley & Sons. Harvey, F. (2015). *A primer of GIS: Fundamental geographic and cartographic concepts*. Guilford Publications. Ian, H. (2010). *An introduction to geographical information systems*. Pearson Education India.
		3.3. Major data feeds to GIS and their characteristics; maps, GPS, images	1:00	3.4. *Filed work*: Assessing the quality of agricultural data obtained from multiple sources (e.g., maps, GPS, satellite images) for precision farming.	2:00	
		3.5. Locating and evaluating data; data formats; metadata.	1:00	3.6. *Field Work:* Collecting spatial data using GPS devices in the field	2:00	
				3.7. *Lab Work:* Importing GPS data into GIS software	1:00	
IV	Fundamental of RS	4.1. Definition, History and Evolution of Remote Sensing, Remote sensing as an Art or Science	2:00			Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). *Remote sensing and image interpretation*. John Wiley & Sons. Chuvieco, E. (2020). *Fundamentals of satellite remote sensing: An environmental approach*. CRC press. Pu, R. (2017). *Hyperspectral remote sensing: fundamentals and practices*. CRC Press.
		4.2. Advantages of Remote sensing, limitation of Remote sensing, Ideal and Real Remote sensing.	1:00	4.3. *Group work*: Collecting , processing and analyzing remote sensing data	1:00	
		4.4. Concept of remote sensing and its Applications in agriculture	2:00	4.5. *Lab work*: Monitoring agricultural crop health using remote sensing techniques.	2:00	
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**16:00**	

Course Syllabus

Semester VIII

Course Code: UPR 480 *Credit Hours:* 6 [Theory: 0; Practical: 6]
Course Title: MU Internship for Human Development (MIHD) *Teaching Hours:* 96

Course Description Upon the completion of MU Internship program for Human Development Services course, the students will be able to design agricultural project for development of entrepreneurship skills for maximizing productivity and profitability.

Course Objectives: The general objective of this course is to empower the learners with a basic understanding of the concepts, values, and virtues of entrepreneurship skill development in the field of agriculture. Specifically, this course aims to –

a. Identify the working area and location of experimental site by site visit/ feasibility study conducted by supervisor
b. Enable the students to develop the project or business plan for establishment of their own business
c. Execute the project and record the investment on input and marketing to make profitable enterprise
d. Build up the capacity of the student to interact with farmers/ stakeholders with respect to farmers related problems and conduct action/ survey/ case study on that issue

Modality: The following modality will be applied for conduction of internship program in GSAF:

1. There will be 4 schemes for conduction of internship program;
   a. MOU between Ministry and MU/GSAF,
   b. University own farms (In station),
   c. Out station in the appropriate location and industry upon availability of external funding and
   d. Foreign country internship program after approval of project from respective embassy.
2. At the time of registration in 7 th semester, a group of 5-10 students with working area / topic of their own choice will be submitted with signature to the concerned authority. The appropriate format /sample. The appropriate format will be developed and given to the students for the choice of topic/ working area along with the name of student.
3. The format will be sent to the respective department based on the topic and nature of the project.
4. The respective department will allot the major, minor and site supervisor/mentor for each group before two months of the end of 7 th semester. The total number of students in each department must not the exceeds 30 % of the total number of batch students.

5. The project/business plan should be developed by each group of student with the consultation of supervisor and it will be defended in the department before one month of the end of 7 th semester
6. zThe financial support will be provided by Dean office as a seed money and student must be returned that seed money after the end of project otherwise result will be withheld, if the student will not return the money within timeline before the result publication.

Eligibility: The students to get the eligibility for registering the internship program must have completed (passed) all the course requirements from 1st to 6th semester. The assignment of the internship program shall be based on interest and merit basis to adjust with the maximum number of seat available in the each department. In case of practical work (Internship program), minimum 2 hrs. will be allocated for one working hrs. as mentioned in GSAF Examination Evaluation System.

Organizational Plan: There will be a three tire organizational set up in GSAF, designed for the purpose of executing internship program to give the real experience and skills of LMDP concept to the student. Accordingly, the chief of the executive will be the Dean of a given graduate school whereas, managing director will be concerned Head of Department and internship in charge will be faculty who supervise the group of student taking internship program. Program in charge will directly work under Head of the concerned Department in GSAF.

The evaluation of internship program will be jointly carried out by the course in charge (mentor/ supervisor), and external examiner. The student must present their report in a seminar and show the strength of project by statistical analysis and presentation. The grading will be based on return of the project, higher the output, higher will be the grade and vice versa. In case of controversial situation the final decision will be made by the Dean of the GSAF. The details of working procedure will be developed by the Dean Office for the efficient management of internship program of GSAF.

Course Contents/ Evaluation

Unit	Project activities	Evaluation				Remarks
		Total Working hrs.	Major Advisor	Minor Advisor	Site Advisor	
i	Feasibility study and Preparation of project proposal	10	4	3	3	
ii	Execution of project and data collection	10	4	3	3	
iii	Mid-term progress report Evaluation	20	8	6	6	
iv	Data analysis and report preparation	20	8	6	6	
v	Manuscript preparation and slide presentation	20	8	6	6	
vi	Attendance and daily diary maintenance	10	4	3	3	
vii	Submission of final manuscript	6	2	2	2	
	Total	96	38	29	29	

Total hours of thematic teaching-learning	16:00	Total hours of practical activities	16:00	

3.1. Course Syllabus

Semester I

Course Code: HRT415 *Credit Hours:* 3 [Theory: 1.0; Practical: 2.0]

Course Title: Principles of Horticulture *Teaching Hours:* 48:00

Course Description: This course comprises learning of basic concepts of cultivation practices of fruit and plantation crop production.

Course Objectives: The general objective of this course is to provide a basic knowledge of horticulture including principle of horticulture production and management in global as well as national and local perspectives.. Specifically, this course aims to –

a. understand the concept and importance of horticulture among the students,
b. know the types and classification of horticultural crops and
c. understand the basic practices and practices of horticulture production

Course Contents:

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Practical Hours	
I	Introduction to Horticulture	1.1.Definition, Branches, Importance, Scope of Horticulture	1:00	1.2. *Lab Work:* Identification of garden tools.	2:00	Adams, C. and Early, M. (2014). Principles of Horticulture. Butterworth-Heinemann publications, USA.
		1.3. Status, Strength and Constraints for Horticulture Development in Nepal	1:00	1.4. *Field Visit*: Identification of fruits, vegetables, ornamental and medicinal plants	1:00	Kumar, N. (2017). Introduction to Horticulture. Oxford and Ibh Publishers.
		1.5. Policy, Plan and Programs for Horticultural Development in Karnali Province	1:00			Singh, J. (2019). Basic Horticulture. Kalyani Pubishers.
						Shrestha, G. K., Baral, D. R., Shakya., S. M. and Gautam, D.M. (2001). Fundamental of Horticulture. IASS Rampur, Chitwan.
		1.6. Classification of Horticultural crops based on botanical and Horticultural characteristics	1:00	1.7. *Field Visit:* Identification of commercial fruits and vegetables grown in Nepal	1:00	
II	Factors affecting the Horticultural production	2.1. Biotic (diseases and pests) and Abiotic factors (moisture, temperature, light, water and salts, etc.) affecting horticultural crop production	1:00	2.2. *Field Visit*: Identification of major diseases and insects of horticultural crops	1:00	Thapa, M. B. and Dhimal, S. (2017). Horticulture development in Nepal: Prospects, challenges and strategies. *Universal Journal of Agricultural Research*, 5(3), 177-189.
				2.3. *Guided discussion:* Post-harvest handling of horticultural crops: washing, pre-cooling, sorting,	1:00	Acharya, A. K. and Kafle, N. (2018).

				"grading," treatments, packaging, and storage		Horticultural Sector Development in Nepal with context of Federal System: Present Status, Future Scope and Way Forward; Development of Food Marketing System in Indian Subcontinent and its Possibilities of Trade Links with Japan. Published by Graduate School for International Development and Cooperation Hiroshima University.
III	Agro-ecological Zoning	3.1. Agro-ecological zoning and niches from Horticultural prospective in Nepal	1:00	3.2. *Guided discussion:* Existing diseases and pests management practices in Surkhet, Dailekh, Jajarkot, Mugu, Kalikot, Jumla, Humla, Dolpa, Salyan and Western Rukum	1:00	
		3.3. Potential zones for horticultural development in Surkhet, Dailekh, Jajarkot, Mugu, Kalikot, Jumla, Humla, Dolpa, Salyan and Western Rukum	1:00	3.3. *Guided discussion:* Existing practices of post-harvest handling of horticultural crops in Surkhet.	1:00	Adhikari, B. and Aarati, G. C. (2021). Post-harvest practices of horticultural crops in Nepal: Issues and management. *Archives of Agriculture and Environmental Science*, 6(2), 227-233.
IV	Types of Horticultural Enterprises	4.1. Introduction to fruit orchards, horticulture nursery, ornamental gardening and landscape, vegetable farming, and post-harvest handling and preservation	1:00	4.2. *Field Work:* Feasibility study of commercial vegetable production in Chinnchu, Surkhet	1:00	
				4.3. *Brainstrom:* Review on current status of post-harvest losses of horticultural crops in Nepal	1:00	
V	Intensive Horticulture Farming	5.1. High density planting, multi-storied cropping and multiple cropping with Horticultural crops	1:00	5.2. *Lab Work:* Assessment of maturity indices of horticultural crops	1:00	
				5.3. *Field Work:* Methods of harvesting of horticultural crops	1:00	
VI	Growth and Development	6.1. Concept of growth and development, dormancy, germination and juvenility	1:00	6.2. *Field Work:* Identification of plant nutrients deficient horticultural crops	1:00	Pun, A. B. and Poudyal, D. (2018). Assessment of present status and action plan development of vegetable seed enterprise in Rukum, Nepal. *Journal of Agriculture and Natural Resources*, *1*(1), 122-132.
		6.3. Flowering, fruit set, fruit growth and development; fruit maturity, ripening, unfruitfulness and fruit drop	1:00	6.4. *Guided discussion:* Biological, mechanical, physical, cultural, and chemicals methods of diseases and pest control	2:00	

VII	Plant growth regulators	7.1. Major PGRs (auxin, gibberellins, cytokinins, ethylene and inhibitors); and its commercial uses in Horticulture	1:00			
VIII	Training and pruning	8.1.Basic concept and methods of training and pruning	1:00	8.2. Field *Work*: Training and pruning of fruits, vegetables and ornamentals	2:00	Schnelle, M. A. (2012). The future potential of horticultural plant discovery, improvement, and production in Nepal. *HortScience*, 47(7), 828-830.
IX	Plant Propagation	9.1. Introduction, and Types of plant propagation: (Sexual and Asexual Methods: cutting, layering, budding, grafting, specialized vegetative parts, tissue culture)	1:00	.9.2. *Field Visit:* Practices of sexual and asexual plant propagation methods: cutting, budding, grafting and layering	3:00	
X	Establishment and management of Horticultural farms/gardens	10.1 Site selection, layout, field preparation and planting	1:00	10.2. *Field Work*: Site selection, preparation and establishment of nursery of fruits and vegetables and their transplanting	4:00	
		10.3. Intercultural operation, manure and fertilizer, irrigation, mulching, weed management and plant protection	1:00	10.4. *Guided discussion*: Types, methods, and doses of fertilizers and manures application	2:00	
				10.5. *Guided discussion:* Methods, frequencies and requirements of irrigation in horticultural crops	2:00	
				10.6. *Field Work*: Intercultural and weed management of horticultural crops	2:00	
				10.7. *Visit*: Visit to horticultural farms and nurseries	2:00	
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	32:00	

3.1. Course Syllabus

Semester II

Course Code: HRT424 *Credit Hours:* 2 [Theory: 1.0; Practical: 1.0]

Course Title: Plant Propagation and Nursery Management *Teaching Hours:* 32:00

Course Description: This course comprises learning of basic concepts of plant propagation and nursery management.

Course Objectives: The general objective of this course is to provide a basic knowledge about principles and practices of plant propagation and nursery management with special emphasis on management practices. Specifically, this course aims to –

a. know the concept and importance of fruits, vegetables and ornamental plants propagation,
b. acquire knowledge and skills about the physiology and techniques of different plant propagation methods
c. learn the techniques and skills for the development of commercial horticultural nurseries

Course Contents:

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Practical Hours	
I	Introduction to plant propagation and nursery management	1.1. Principle of plant propagation, history, principle of totipotency and brief introduction to nursery	1:00	1.2.*Group Discussion*: Feasibility study on fruit nurseries in Karnali Province	1:00	Bose, T.K., Mitra S.K. and Sadhu M.K. (1991). Propagation of Tropical and Subtropical Horticultural Crops. Naya Prokash, India.
		1.3. Plant propagation methods and classification; sexual and asexual methods of propagation and their advantages and disadvantages	1:00			
		1.4. Present status and scope of fruit and vegetable nurseries in Karnali	1:00	1.5. *Field Work*: Survey study on domestic production and supply (formal and informal) of fruit saplings and vegetable seeds	1:00	Rajan S. and Baby L.M. (2007). Propagation of Horticultural Crops. New India Publ. Agency, India
		1.6 Existing practices of horticultural plants propagation techniques in Karnali Province	1:00			

II	Physiology of seed and plant propagation	2.1. Seed germination, and viability; dormancy and causes of seed dormancy and methods of breaking dormancy	1:00	2.2. *Lab and Field Work*: Seed treatments for breaking seed dormancy of potato tubers	1:00	Kumar, N., & Reddy, M.P. (2011). In vitro plant propagation: a review. *Journal of forest and environmental science*: *27*(2), 61-72.
		2.3. Apomixis, poly-embryony, chimera and bud sports	1:00	2.4. *Field Work*: Preparation and application of plant growth regulators for seed germination and vegetative propagation	1:00	Gurung, C.T., & Gurung, A. (2014). Chemical growth regulator mediated propagation of Dendrobium 'Rinnapa'Lek Dee Dee and its comparative analysis with other methods of propagation.
		2.5. Physiological and biochemical basis of rooting; and factors influencing rooting of cuttings and layering	1:00	2.6. *Lab and Field Work*: Seed treatments for breaking seed dormancy of potato tubers	1:00	
		2.7. Graft incompatibility; anatomical studies of graft/bud union and scion-stock relationship and their influences	1:00			
III	Techniques of different vegetative propagation methods	3.1. Techniques and agronomical management of cutting and layering methods	1:00	3.2. *Field Work*: Establishment of fruit nursery: Site selection, layout and preparation of nursery beds; preparation of potting media, seed sowing and potting	1:00	
		3.3. Techniques and agronomical management of grafting and budding methods	1:00	3.4. *Field Work*: Practice of soft-wood cutting in ornamental plants	1:00	Relf, D., & Ball, E. C. (2009). Propagation by cuttings, layering and division.
				3.5. *Field Work*: Practice of budding in rose	1:00	
		3.6. Techniques of propagation through specialized organs: tubers, corms, runner, suckers, rhizome, bulb, etc.	1:00	3.7. *Field Work*: Propagation through runners, bulbs, corms, tubers and rhizomes	1:00	
				3.8. *Field Work*: Practice of Air-layering on Litchi	1:00	da SILVA, J.A.T., & Acharya, K.P. (2014). In Vitro propagation of Nepalese orchids: a review. *Journal of Horticultural Research*: *22* (2).
		3.9. Selection and maintenance of mother trees; and selection and	1:00	3.10. *Field Work*: Practice of Inarching in mango	1:00	

		collection of scion woods				
		3.11. Concept and techniques of tissue culture	1:00	3.12. *Field Work*: Practice of shoot tip grafting in mandarin	1:00	Bhandari, N., Basnet, M., & Khanal, S. (2021). Standardization of Grafting Time of Mandarin (Citrus Reticulata Blanco) in Central Mid Hill of Nepal. *International Journal of Fruit Science: 21*(1), 599-608.
IV	Establishment and management of fruit nurseries	4.1. Types of nurseries, and its components	1:00	4.2. *Field Work*: Raising of rootstocks for the grafting of mango and roses	1:00	
		4.3. Nursery bed preparation, different potting media, seeding, planting, transplanting and nursery care	1:00	4.4. *Lab and Field Work*: Selection and collection of quality scion wood sticks of mango, and citrus	1:00	Roberto, S.R., & Colombo, R.C. (2020). Innovation in propagation of fruit, vegetable and ornamental plants. *Horticulturae: 6* (2), 23.
		4.5. Propagation structures: screen house/green houses,/glass-houses/poly-houses/cold frames and hot-beds, irrigation and fertigation structures	1:00	4.6. *Field Work*: Raising of rootstock and grafted saplings under screen house	1:00	
				4.7. *Field Work*: Nursery management with respect to fertilizer and manures, irrigation, mulching, plant protection, intercultural operation and nursery care	1:00	
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**16:00**	

3.1. Course Syllabus

Semester III

Course Code: HRT434 *Credit Hours:* 3 [Theory: 2.0; Practical: 1.0]

Course Title: Fruit and Plantation Crop Production *Teaching Hours:* 48:00

Course Description: This course comprises learning of basic concepts of cultivation practices of fruit and plantation crop production.

Course Objectives: The general objective of this course is to provide a basic knowledge about principles and practices of fruit and plantation crop production with special emphasis on management practices. Specifically, this course aims to –

a. provide knowledge with basic concepts of fruit and plantation crop production among the students,
b. develop skills of fruit and plantation crop production
c. learn the cultivation practises for fruit and plantation crop production

Course Contents:

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Practical Hours	
I	Introduction to fruit and plantation crop	1.1. Importance, scope and constraints of fruit and plantation crop production in Nepal	1:00	1.2. *Field Visit:* Identification of major temperate, subtropical and tropical fruit trees.	1:00	Atreya, P. N., & Manandhar, R. (2016). Fruit crop development in Nepal: Achievements and future strategy. In Proceeding of the First International Horticulture Conference at Kathmandu, Nepal Horticulture Society, Lalitpur, Nepal. Thapa, M. B., & Dhimal, S. (2017). Horticulture development in Nepal: Prospects, challenges and strategies. Universal Journal of Agricultural Research, 5(3), 177-189.
		1.3. Potential areas for commercial fruit and plantation crops	1:00	1.4. *Field Work:* Layout and land preparation for establishment of orchard	2:00	Shrestha, G. K. (2010). Applied fruit science. Sajha Prakashan, Lalitpur, Nepal, 151-162.

	practices of Plantation crops	4.3. Coffee	2:00	4.4. *Guided discussion*: Preparation of project for fruit farm enterprise establishment	1:00	spices, plantation crops, medicinal and aromatic plants. Oxford and IBH Publishing.
Total hours of thematic teaching-learning			**32:00**	**Total hours of practical activities**	**16:00**	

3.1. Course Syllabus

Semester IV

Course Code: HRT443 *Credit Hours:* 2 [Theory: 1.0; Practical: 1.0]

Course Title: Vegetable Production *Teaching Hours:* 32:00

Course Description: This course comprises learning of basic concepts of cultivation practices for vegetable crop production.

Course Objectives: The general objective of this course is to provide a basic knowledge about principles and practices of vegetable crop production with special emphasis on management practices. Specifically, this course aims to –

a. provide knowledge with basic concepts of vegetable crop production among the students,
b. develop skills of vegetable crop production, and,
c. learn the cultivation practises and management for vegetable crop production

Course Contents:

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Practical Hours	
I	Introduction to vegetable crop	1.1 Importance, scope, distribution and constraints of vegetable crop production in Karnali Province.	1:00	1.2. *Field Visit:* Identification of seasonal vegetable crop plants with their edible parts	1:00	Timsina, K. P., & Shivakoti, G. P. (2018). Vegetables production and marketing: practice and perception of vegetable seed producers and fresh growers in Nepal. *Agriculture & Food Security*, 7(1), 1-9.
				1.3 *Group Discussion*: Identification of seeds of vegetable crops and preparation of catalouge	1:00	
II	Cultivation practices of cole vegetable crops	2.1. Cauliflower and Broccoli	2:00	2.2. *Field Work:* Layout of kitchen garden and nursery bed preparation	1:00	https://horticulturenepal.org/uploads/main_attachment/1630665497_Horticultural%20In%20last%20six%20decades-60-88.pdf Swarup, V. (2006). Vegetable Science and Technology. Kalyani Publication., New Delhi.
		2.3. Cabbage and Knolkhol	1:00	2.4. *Field Work*: Nursery raising of seasonal vegetable crops	1:00	
III	Cultivation practices of root crops	3.1. Radish	1:00	3.2. *Lab and Field Work*: Calculation and application of manure and fertilizers doses	1:00	
		3.3. Carrot and Turnip	1:00			
IV	Cultivation practices of	4.1. Tomato	1:00	4.2. *Field Work*: Transplanting of the vegetable seedlings	1:00	ICAR, (2001). Text Book of Vegetables, Tuber Crops and Spices,

	vegetable fruit crops	4.3. Brinjal and Okra	1:00	4.4. *Field Work*: Practises of inter-cultural operations (gap filling, mulching, weeding, etc)	2:00	(Ed. S. Thamburaj and Narendra Singh), ICAR, New Delhi, India Singh, K.P. and Bhandari, R.R. (2019). Vegetable Crops Production Technology Samiksha Publication. (ISBN: 9789937290364).
V	Cultivation practices of tuber crops	5.1. Potato	1:00	5.2. *Field Work*: Practises of training, staking and pruning	1:00	
		5.3. Sweet potato, yam and colocasia	1:00	5.4. *Lab and Field Work*: Preparation and application of PGRs and plant nutrients	2:00	
VI	Cultivation practices of leafy vegetable crops	6.1. Broad leaf mustard	1:00	6.2. *Field Work*: Harvesting and postharvest handlings of the harvested vegetable crops	1:00	Karki, B. and Gautam, D.M. (2019). Commercial Vegetable Production. Heritage Publishers & Distributors Pvt. Ltd. (ISBN: 9789937703789).
		6.3. Spinach, lettuce, Swiss chard and Cress	1:00	6.4. *Brainstorm:* Display and judging of the harvested vegetables crops	1:00	
VII	Cultivation practices of cucurbitace-ous vegetable crops	7.1. Cucumber	1:00	7.2. *Field Visit:* Visit to farmers' commercial vegetable farm	1:00	Rana, M.K. (2011). Fundamentals of Vegetable Production. New India Publishing Agency - NIPA. (ISBN-10 : 9789380235707). Pandey, I.R. and Pandey, R.R. Taja Tarkari -Principles And Practices Related To Vegetable Production In Nepal. Samiksha Publication. (ISBN/ISSN: 978-9937-759-70-0).
		7.3. Bitter gourd and bottle gourd	1:00			
		7.4. Pumpkin and squash	1:00	7.5. *Field Visit:* Visit and study of local vegetable markets	2:00	
		7.6. Watermelon and muskmelon	1:00			
Total hours of thematic teaching-learning			16:00	Total hours of practical activities	16:00	

3.1. Course Syllabus

Semester V

Course Code: HRT453 *Credit Hours:* 3 [Theory: 1.0; Practical: 2.0]

Course Title: Ornamental Plant Production *Teaching Hours:* 48:00

Course Description: This course comprises learning concepts of cultivation practices for ornamental plant production.

Course Objectives: The general objective of this course is to provide a basic knowledge about principles and practices of ornamental plant production with special emphasis on management practices. Specifically, this course aims to –

a. provide knowledge with basic principles of ornamental plant production among the students,
b. develop skills on landscape gardening and ornamental plant production
c. learn the cultivation practises and management for ornamental plant production

Course Contents:

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Practical Hours	
I	Introduction and classification of ornamental plants	1.1 Importance and history of ornamental plant production	1:00	1.2. *Field Visit:* Identification of ornamental plants and herbariun collection	2:00	Pun, U. K. (2019). Floriculture in Federal Nepal: Present status and way forward. *Nepalese Floriculture, 23*(1-6).
		1.3 Classification based on flowering and foliage ornamentals				
II	Landscape gardening	2.1. Definition, history, features and components of landscape gardening	1:00	2.2. *Field Work:* Preparation of flower bed/seed bed/nursery bed	2:00	Pun, U., & Tripathi, K. M. (2016). Floriculture in Nepal: A new and vibrant sub sector of horticulture. *Six decades of Horticulture Development in Nepal*, 83-92.
		2.3. Principle, styles of landscape gardening	1:00	2.4. *Field Work*: Practices in landscape gardening design	2:00	
III	Lawn Management	3.1. Introduction- selection of grasses, planting sowing of seeds and its management	1:00	3.2. *Field Work*: Designing and preparation of lawn	2:00	Kalauni, D and Joshi, A. (2018). A Textbook of Ornamental Horticulture. Heritage Publishers & Distributions Pvt. Ltd., Kathmandu.
IV	Flower arrangements	4.1. Importance and styles in flower arrangements	1:00	4.2. *Field Work*: Raising of seasonal flowering ornamental plants	2:00	Arora, J S. (2021). Introductory Ornamental Horticulture. Kalyani

		4.3. Types of flower arrangements- Eastern and Western	1:00	4.4. *Field Work:* Practises of different types of flower arrangements	2:00	Publishers, New Delhi. Karki, B. and Joshi P. (2019).Ornamental Horticulture and Nursery Management. Heritage Publishers & Distributions Pvt. Ltd., Kathamndu. Ingels, J E. (2009). Ornamental Horticulture. Cengage Learning, USA.
				4.5. *Lab Work*: Exhibition and judging of ornamental plants	2:00	
V	Bonsai	5.1. Introduction, history and selection of plants for bonsai	1:00	5.2. *Field Work*: Practises of training and pruning of ornamental plants	2:00	
		5.3. Style and management of bonsai	1:00	5.4. *Lab and Field Work*: Preparation of bonsai	2:00	
VI	Indoor gardening	6.1. Meaning, care and management of indoor plants	1:00	6.2. Lab and *Field Work*: Preparation of media & practises of potting and repotting of ornamental plants	2:00	Kumar, B and Singh, B. (2020). Introductory Ornamental Horticulture and Landscape Gardening. Bio-Green Books, India.
				6.3. *Lab Work:* Interiorscaping and maintenance of indoor plants	2:00	
VII	Cultivation practices of important cut and loose flowers	7.1. Rose	1:00	7.2. *Field Work:* Raising of seasonal foliages ornamental plants	2:00	Bose, T.K. and L.P. Yadav (1989). Commercial Floriculture, Naya Prakash, Calcutta. Bose T.K., Maiti R.G., Dhua R.S. and Das P. (1999). Floriculture and Landscaping. Naya Prokash., India. Sabina G.T. and Peter K.V. (2008). Ornamental Plants for Gardens. New India Publ. Agency, India
		7.3. Carnation	1:00			
		7.4. Gerbera and chrysanthemum	1:00	7.5. *Field Work:* Intercultural operations during cultivation of flowers and foliages	2:00	
		7.6. Gladiolus	1:00	7.7. *Field and Lab Work:* Harvesting and postharvest management of harvested flowers and foliages	2:00	
		7.8. Marigold and gomphrena	1:00			
		7.9. Tuberose and orchids	1:00	7.10. *Brainstrom:* Development of project on floribusiness enterprises	2:00	Randhawa, G.S. and A. Mukhopadhyhy (1986). Floriculture in India. Allied Publisher, India.
		7.11 Birds of paradise and anthurium	1:00	7.12. *Field Visit:* Visit to flori farm at local level	2:00	
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**32:00**	

3.1. Course Syllabus

Semester VI

Course Code: HRT462 *Credit Hours:* 2 [Theory: 1.0; Practical: 1.0]

Course Title: Agroforestry and Indigenous Horticultural Crop Production *Teaching Hours:* 32:00

Course Description: This course comprises learning concepts for agroforestry practices and indigenous horticultural crop production.

Course Objectives: The general objective of this course is to provide a basic knowledge about principles and practices of agroforestry systems and indigenous horticultural crop production. Specifically, this course aims to –

a. provide knowledge with practises of agroforestry systems and its importance,
b. learn the cultivation practises for indigenous horticultural crop
c. develop skills on agroforestry systems models and indigenous horticultural crop production

Course Contents:

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Practical Hours	
I	Introduction to Agroforestry	1.1 Definition, components, importance and scope of agroforestry in Nepal	1:00	1.2. *Field Visit and Work:* Identification of important agroforestry crops and herbarium collection	2:00	Atreya, K., Subedi, B. P., Ghimire, P. L., Khanal, et al. (2021). Agroforestry for mountain development: Prospects, challenges and ways forward in Nepal. *Archives of Agriculture and Environmental Science*, *6*(1), 87-99.
		1.3 Importance of trees for agroforestry development	1:00			
II	Classification and Factors	2.1. Classification of agroforestry systems	1:00	2.2. *Field Work*: Preparation of A frame	1:00	
		2.3. Factors affecting the agroforestry systems	1:00	2.4. *Field Work*: Nursery preparation and plantation of agroforestry crops	2:00	Ghimire, M., Khanal, A., Bhatt, D., Dahal, D., & Giri, S. (2024).

III	Systems and Techniques in Agroforestry	3.1. Practises, problems and potential in shifting cultivation	1:00	3.2. *Field Work*: Design and practises of developing different agroforestry models	2:00	Agroforestry systems in Nepal: Enhancing food security and rural livelihoods–a comprehensive review. *Food and Energy Security*, *13*(1), e524.
		3.3. Techniques of silviculture in agroforestry	1:00			
IV	Apporaches and Models	4.1. Modern agroforestry systems	1:00	4.2.*Field Visit*: Visit to community forest/agroforestry project	1:00	Naresh R.K., Dhaliwal, S.S., Tomar, S.S. et. (2019). Agroforestry and Its Applications. Narendra Publishing House, New Delhi.
		4.3. Models for agroforestry	1:00			
V	Introduction to Indigenous Horticultural Crop	5.1. Definition, importance, scope and challenges for indigenous horticultural crop production	1:00	5.2.*Field Visit*: Identification of indigenous horticultural crop	1:00	Thapa, M. B., Gotame, T. P., & Dhimal, S. (2021). Distribution of Underutilized Fruit in Nepal: Strategies for Conservation and Utilization. www.horticulturenepal.org
		5.3. Nutritive value and health benefits	1:00	5.4. *Field Work*: Land preparation and raising of seedlings/propagation of crops	2:00	
VI	Cultivation practices for important indigenous horticultural crops	6.1. Kafal and Ainselu	1:00	6.2. *Field Work:* Transplanting/ planting of cuttings or propagated parts	2:00	Shrestha, D. (2013). Indigenous vegetables of Nepal for biodiversity and food security. *International Journal of Biodiversity and Conservation*, *5*(3), 98-108. Sivakumar, D., Netzel, M., Sultanbawa, Y. (2022). Handbook of Phytonutrients in Indigenous Fruits and Vegetables. Centre for
		6.3. Lapsi and Imali	1:00			
		6.4. Chiuri and Chutro	1:00	6.5. *Field Work:* Intercultural operations during raising of cultivated plants	2:00	
		6.6. Neuro and Kundruk	1:00			
		6.7. Latte and Sisnu	1:00	6.8. *Field Visit:* Visit to indigenous horticultural crops	1:00	

		6.9. Rhododendron , Lalupate and Bojho	1:00	cultivated farm at local level		Agriculture and Bioscience International, U.K Eggadi Ramesh, Vangapandu Thriveni, S. Deepti and Anant Tamang .(2024). Unveiling of Underexploited Horticultural Crops. New Delhi Publishers. India.
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**16:00**	

3.1. Course Syllabus

Semester VII

Course Code: HRT472 ***Credit Hours:*** 3 [Theory: 1.0; Practical: 2.0]

Course Title: Protected Horticulture and Post Harvest Technology ***Teaching Hours:*** 48:00

Course Description: This course comprises learning concepts for principles and practices of protected cultivation and post harvest technology of horticultural crops.

Course Objectives: The general objective of this course is to provide a basic knowledge on protected cultivation practises and post harvest technology of horticultural crops. Specifically, this course aims to –

a. provide knowledge with principles and practises of protected cultivation of horticultural crops,
b. learn the techniques for post harvest management of horticultural crops
c. develop skills on protected horticulture practises and post harvest technology

Course Contents:

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Practical Hours	
I	Introduction to Protected Horticulture	1.1 Definition, status, importance and scope of protected cultivation in Nepal	1:00	1.2. *Field Work:* Construction of low cost protected structures	2:00	Mahesha K.N., Reddy, K.H., Guddaraddi, A., Shrilatha K.A., Mallikarjuna K.N. and Koti,S. (2024). A Text Book on Protected Cultivation in Horticulture: A Cultivating Eden. AkiNik Publications, India.
		1.3 Types of protected structures	1:00	1.4. *Field Work:* Raising of seedlings and saplings under protected structure	2:00	
II	Planning and Design for protected structure	2.1. Components and growing conditions for green house	1:00	2.2. *Field Work:* Quality planting materials production in pro-trays	2:00	Singh, D.K. and Peter, K.V. (2014). Protected Cultivation of Horticultural Crops. NIPA India.
		2.3. Irrigation and fertigation methods in green house	1:00	2.4. *Field Work*: Bed prepartion and transplanting of crop	2:00	
III	Cultivation	3.1. Tomato	1:00	3.2. *Field Work*: Intercultural	2:00	Prabhakar,I., Manjunatha, B.L. and

	practices for important horticultural crops	3.3. Cucumber	1:00	operations- irrigation and fertigation practises		Swetha, B.S. (2020). Protected Cultivation of Horticulture Crops. Satish Serial Publishing House. New Delhi, India.
		3.4. Rose	1:00	3.5. *Field Visit*: Visit to nearby protected cultivation farm	2:00	
		3.6. Gerbera	1:00			
IV	Introduction to Post Harvest Technology	4.1. Definition, status, importance of post harvest horticulture in Nepal	1:00	4.2. *Lab Work*: Identification of tools and equipment used in post-harvest technology	2:00	Khatiwada, P. P., & Bahadur, K. C. H. (2021). Status of postharvest handling of fresh produces in Nepal and interventions to minimize the losses. In *V Asia Symposium on Quality Management in Postharvest Systems 1336* (pp. 23-30).
		4.3. Physiology of crop and causes of post harvest losses	1:00	4.4. *Lab Work:* Determination of total soluble solids and	1:00	Wills, R B.H, WB. McGlasson, D. Graham, T.H. Lee and E.G. Hall. (1996). Postharvest: An Introduction to Physiology and Handling of Fruits and vegetables. CBS Publishers and Distnbutors4596/1A, 11 Dariyaganj, New Delhi 110002, India
				4.5. *Lab Work:* Determination of tritable acidity	1:00	
V	Factors affecting quality of crop	5.1. Pre and post harvest factors affecting the harvested commodity	1:00	*5.2. Field Work*: Maturity judgment and harvesting of fruits and vegetables	2:00	Bhardwaj, R. L., Sharma, Y. K., & Vyas, L. (2021). Postharvest Handling of Horticultural Crops. CRC Press.
		5.3. Maturity indices of horticultural crops	1:00	5.4. *Lab Work*: Drying or dehydration of fruit and vegetables	2:00	
VI	Processing and Preservation of harvested commodities	6.1. Cleaning, Pre-cooling, sorting, grading, treatments, storage and transportation of harvested crops	2:00	6.2. *Lab Work*: Post harvest treatments of harvested commodities -cleaning/ sorting/grading/waxing/packaging	2:00	Siddiqui, M.W. and Ali, A. (2016). Postharvest Management of Horticultural Crops. Apple Academic Press.
				6.3. *Lab Work*: Preparation of jam/jelly	2:00	

		6.4. Value addition of horticulture commodity- jam, jelly, pickles, syrup	1:00	6.5. *Lab Work*: Preparation of tomato ketchup/sauce	2:00	Beigh, M.A. (2022). Handbook on Postharvest Management of Horticulture Crop. Narendra Publishing House, Delhi, India.
				6.6. Lab *Work*: Preparation of pickles	2:00	
VII	**Postharvest management of crops and enterprises development**	7.1. Post-harvest management of harvested cut and loose flowers	1:00	7.2. Lab *Work*: Post-harvest treatments of harvested flowers-pulsing/packaging	2:00	Bhattarai, D.R., Gautam, D.M and Maharjan, S.K. (2020). Postharvest Technology. Heritage Publishers & Distributors Pvt. Ltd., Nepal
				7.3. *Field Work*: Survery and proposal writing for post harvest enterprises	2:00	
Total hours of thematic teaching-learning			**16:00**	**Total hours of practical activities**	**32:00**	

3.1 Syllabus

Semester I

Course Code: OAG417 *Credit Hours:* 2:0 [Theory: 1.0; Practical: 1.0]

Course Title: Agroecology and Climate Change *Teaching Hours*: 32:00

Course Description: Introduction to agro-ecology; Definition, elements, importance, scope and history of agro-ecology,Principles of agro-ecology, Farmhouse ecology and ecological principles and agro-ecosystem dynamics;Understanding and analysis of agro-ecological components of farmhouse / home gardens,Components of Agro-ecosystem, their linkages, Energy flow, ecological pyramids, food chains, food webs and tropic level, Environmental impacts on agriculture; Ecological degradation due to chemical agriculture, deforestation and soil erosion, Declining soil fertility, soil productivity and farm profitability and reduction in biodiversity. Food quality degradation, water bodies contamination, Bio-magnification and health hazard, Climate change; Trend of climate change , Greenhouse gas, effect, global warming and climate change, Source and sink of greenhouse gases, Impacts of climate change on agriculture and biodiversity, ocean and household, planning Adaptation, mitigation and preparedness, Biodiversity, Conservation, Conservation Agriculture and management strategies; Biodiversity Conservation and management strategies, Conservation agriculture (CA) and principles of CA and Organic farming, Ecological aspects of CA and Sloping Agricultural Land Technology (SALT). Sustainability of Agro-ecosystem; Definition, advantage and limitation for sustainable agriculture, As a Properties for Agro-ecosystem Assessment: Productivity, stability, equitability, sustainability and autonomy , Challenges, strategies and requirement of sustainable agriculture, Agro-ecology and climate change status; Agro-ecological zones of Nepal, Types of climates based on geography of Nepal, status of biodiversity in Nepal and climate smart technologies adopted in Nepal, Different organization involved in climate change mitigation strategies and different government policies, Agro-ecosystem and climate of Karnali province; Indigenous crops and livestock found in Dolpa, Humla, Jumla, Kalikot, Dailekh, Jajarkot, Salyan, East Rukum, Salyan and Surkhet of Karnali province, Various types of crops and livestock found in different agro-ecological regions of Karnali province.

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

a. To understand theconcept and relevance of agro-ecology in Nepalese agriculture and biodiversity,
b. apply the concept of climate change for adaptation to and mitigation in Nepalese agriculture in general and Karnali', agriculture and biodiversity in particular, and
c. develop management strategies for sustainable agriculture and conservation of biodiversity in Nepal scales.

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture hours	Practical Elements of Learning	Practical hours	
I	Introduction to Agroecology	1.1 Definition, elements, importance, scope , history of agro-ecology and Principles of agro-ecology	2	1.2 *Observation and review :* Review and analyze the properties of different Agro-ecosystem	1	Gliessman, S. R. (2014). Agroecology: The Ecology of Sustainable Food Systems, Kindle Edition, CRC Press
		1.3 Agro-ecological zones of Nepal, Types of climates based on geography of Nepal, status of biodiversity in Nepal and climate smart technologies adopted in Nepal.	1	1.4 *Observation and review :*SWOT analysis of sustainable agriculture	1	Subedi B.P. (2014).The State of Geography Teaching and Research in Nepal, Martin Chautari
		1.5 Definition, advantage and limitation for sustainable agriculture, As a Properties for Agro-ecosystem Assessment: Productivity, stability, equitability, sustainability and autonomy, Challenges, strategies and requirement of sustainable agriculture	1	1.6 *Field observation :* Study of indicators of sustainable agriculture	1	Modi, H.A. (2012). Sustainable Organic Agriculture Various resoureces available in websites
II	Farmhouse ecology and ecological principles and agroecosystem dynamics	2.1 understanding and analysis of agroecological components of farmhouse/home garden	1	2.2 *Field work :* Different pest management strategies in crop field	1	Alteri, M.A. (1995). Agroecology: The Science Of Sustainable Agriculture, Second Edition, CRC Press
		2.3 Components of Agro-ecosystem, their linkages, Energy flow, ecological pyramids, food chains, food webs and trophic level	1	2.4 *Field observation :* Study of greenhouse in nearby area.	2	Publications of HICAST on Sustainable Agriculture
III	Environmental impacts on agriculture	3.1 Ecological degradation due to chemical agriculture, deforestation and soil erosion	1	3.2 *Field observation :* Study of farm house and home garden	1	

		3.3 Declining soil fertility, soil productivity and farm profitability and reduction in biodiversity	1	3.4 *Field observation and review :* Study the different practices of Conservation Agriculture	2	
		3.5 Food quality degradation, water bodies contamination, Bio-magnification and health hazard	1			
IV	Climate change	4.1 Trend of climate change , Greenhouse gas, effect, global warming and climate change, Source and sink of greenhouse gases	1	4.2 *Field observation and review :* Different climate change adaptation practices in Karnali province	1	Lal, R.et (2014). Global Climate Change and Cold Regions Ecosystems, Today & Tomorrow's Printers and Publishers
		4.3 Impacts of climate change on agriculture and biodiversity, ocean and household, planning Adaptation, mitigation and preparedness	1	4.4 *Field observations:* Study the different practices of Conservation Agriculture	1	Climate Change and Agriculture 2020 . Bonkeblia, N. eds. (2022). Climate Change and Agriculture: Perspectives, Sustainability and Resilience, Wiley
		4.5 Different organization involved in climate change adaptation and mitigation strategies and different government policies	1			Publications of Various Government and Non Government Organizations
V	Biodiversity, Conservation, Conservation Agriculture and management strategies	5.1 Biodiversity Conservation and management strategies	1	5.2 *Farm visit :* Visit to the various organic farm of Nepal	1	Parameshwor, S. (2013).Biodiversity Based Organic Farming, Today & Tomorrow's Printers and Publishers
				5.3 *Field observation :* Study of insect diversity in nearby field	1	
		5.3 Conservation agriculture (CA) and principles of CA and Organic farming, Ecological aspects of CA and Sloping Agricultural Land Technology (SALT)	1	5.4 *Field work :* Demonstration of SALT model	2	Somasundaram, J et al (20140. Conservation Agriculture for Carbon Sequestration and Sustaining Soil Health, Today &

						Tomorrow's Printers and Publishers
VI	Agro-ecosystem and climate of Karnali province	6.1 Indigenous crops and livestock found in Dolpa, Humla, Jumla, Kalikot, Dailekh, Jajarkot, Salyan, East Rukum, Salyan and Surkhet of Karnali province	1	6.2 *Field visit :* Study of Agro-biodiversity in nearby farm	1	District Profiles and publications of NARC, MoALD and I/nGoS working I Karnali
		6.3 Various types of crops and livestock found in different agro-ecological regions of Karnali province	1			Materials published in Papers and Periodicals about Karnali Agriculture
			16		16	

3.1 Syllabus

Semester II

Course Code: OAG427 *Credit Hours:* 2:0 [Theory: 1.0; Practical: 1.0]

Course Title: Mountain Organic Agriculture *Teaching Hours:* 32:00

Course Description: Definition, Concepts; Definition, Concepts and their inter-relationships: Sustainable Agriculture, Organic agriculture,MountainOrganicAgriculture,GlobalHistoryandstatusofOrganicAgriculture;GlobalHistoryof Organic Agriculture, Present Status ofOrganic Agriculture inthe World, Role ofMountainOrganic Agriculture in Sustainable Mountain Development, Principles of Organic Agriculture; Principles of Organic Agriculture, Fundamentals of Organic Agriculture, Bio-fertilizers and Bio pesticide; Bio-fertilizers used in Organic Agriculture,Bio-pesticidesused inOrganic Agriculture, Weed,Insect-Pestand Disease ManagementinOrganic Agriculture;Weed EcologyandOrganic Weed Management, PestEcologyand Organic PestManagement, Soil Ecology; Soil Health & Ecology, Soil Fertility & Organic Nutrient Management, Soil Microbial Diversity, Economics of Organic Agriculture; Profitability of Organic Agriculture, Organic Seed Production in Nepal; Organic Seed Production in Nepal, Organic agriculture in Karnali Province; MOA initiatives and future direction in Karnali Province, Organic Farming of Himalayan Indigenous Crops of Karnali region, An Insight of Organic Agriculture Act of Karnali Province.

Course Objectives:

After completion of this course students will be able to

a. To understand the basic concept of organic agriculture, importance and itsstatus
b. To analyze the various practice of organic soil and pest management
c. To plan, design and develop organic farm management strategies for profitable and sustainable organic agricultural farms in Nepalese mountain environment in general and in Karnali.

Course Contents:

Unit	Macro Level Contents	Micro Level Contents				
		Theoretical Elements of Learning	Lecture hours	Practical Elements of Learning	Practical hours	References
1	Basic concept of Organic agriculture	1.1 Introduction, Scope and Importance of Organic agriculture.	1:00	1.2 *Review and write-up:* Writing Proposal for Experiment on OA	2:00	Chand, S. (2016). Organic Farming Concepts, Application and Advances,Today

						&Tomorrow's Printers and Publishers Pandey, T .D .et al (2014). Organic Farming, Today & Tomorrow's Printers and Publishers Gangwar, B. (2016). Organic Farming : Technologies and Strategies
		1.3 Economics of Organic Agriculture	1:00	1.4 *Review :* Review of research articles on OA	2:00	
		1.5 Historical development of organic agriculture	1:00	1.6 *Review :* Study the different practices of conservation Agriculture in world	1:00	Singh, H P & George V T. (2016). Organic Horticulture: Principles Practices and Technologies
2	Organic Soil Fertility Management	2.1 Soil fertility and organic soil management	1:00	2.2 *Field work :* Study the practice the use of EM	1:00	Magdoff, F & R R Weil (2014). Soil Organic Matter in Sustainable Agriculture Panda, H &D.Hotaeds (2014). Biofertilizers and Organic Farming Choudhary, A.K. (2014). Organic Farming Biofertilizers and Biopesticides Technology

		2.3 Compost and vermin-compost	1:00	2.4 *Field observation :* Study the efficiency of different organic fertilizers	1:00	Lal, L.& D K Gupta (2012).Composting Technology
		2.5 Soil Fertility and Mycorrhizae	1:00	2.6 *Field work :* Study the process of making compost fertilizer	1:00	Rai, M. (2015). Hand Book of Microbila fertilizers.
		2.7 Cover Crops, Importance in organic agriculture	1:00	2.8 *Field work :* Study the practice of vermin-composting	1:00	Singh, K.& R. Rai (2014). Management of Industrial Effluents through Vermicomposting
		2.9 Organic Crop Production	1:00			
		2.10 Season Extension for Organic Crops	1:00			
3	**Organic Pest Management**	3.1 Organic Soil Insect Management	1:00	3.2 *Market Observation:* Identification and uses of different organic fertilizers and organic pesticides.	1:00	Sathe, T. V. (2014). Recent Trends in Biological Pest Control,
		3.3 Organic Weed Management/biocontrol	1:00	3.4 *Field visit and review :* Study of different organic farms of Nepal.	1:00	
		3.5 Organic Plant Pathogen Management	1:00	3.6 *Observation:* Visit different organic farms in the area	2:00	
		3.7 Organic Agriculture Extension In Nepal	1:00	3.8 *Field work :* Demonstrate the process of making Jholmol	1:00	

4	**Organic agriculture status and food system**	4.1 Development of Organic Agriculture in Nepal	1:00	4.2 *Review and market analysis :* Study of different organic products being exported	1:00	Publications of Nepal Permaculture Group, LIBiRD, ANSAB and Allieds.
		4.3 Various types of Food Systems in different Jumla, Humla, KalikotandMugu district of Karnali province	1:00			
		4.4 Potentiality of Organic Agriculture in Karnali province	1:00	4.5 *Field visit :* Visit different certified organic farms in the Area	1:00	
			16		16	

3.1 Semester III

Course Code: OAG446 *Credit Hours:* 3.0 [Theory: 1.0; Practical: 2.0]

Course Title: Medicinal and Aromatic Plant Production *Teaching Hours:* 48

Course Description:

This course includes the theoretical and practical aspects of Introduction and history of Medicinal and Aromatic plants (MAPs), Importance, Scope and constraints of MAP, National and provincial status of MAPs , Extraction and storage methods of medicinal and aromatic plants, Use of medicinal plants in Folk remedies and other traditional health care system, Use of medicinal and aromatic plant in organic agriculture production and Origin, distribution, description and chemical evaluation of medicinal and aromatic plants.

Course Objectives: The general objective of this course is to impart the knowledge of medicinal and aromatic plants, their importance, production, extraction and uses. More specifically this course aims to

a. Impart the knowledge in importance and scope of medicinal and aromatic plants in Nepal
b. Enable student about the production, processing and herbs and essential elements from MAP
c. Acquire knowledge about the relation of MAPs in Ayurveda

Macro Level Contents	Micro Level Contents				
	Theoretical Elements of Leaching	**Lecture Hours**	**Practical Elements of Learning**	**Lecture Hours**	**References**
1. Introduction	1.1 Introduction, history, Importance, prospects and constraints of medicinal and aromatic plants	1:00	1. 2. *Field work :* Collection and identification of medicinal plants.	2	Lamsal,G. G. Rawal, S.K. Maharajan and S. Khanal (2022)Textbook of NTFP, Medicinal & Aromatic Plants, Heritage Publishers & Distributors Pvt. Ltd Bhattacharjee, S.K. 2004. Hand Book of Aromatic Plants, Pointer Publisher, Jaoipur, India.
	1.3 Classification of Medicinal and Aromatic Plants	1:00	1.4 *Field work :* Collection and identification of aromatic plants.	2	IUCN Nepal. 2004. Natioal Register of Medicinal Plants, IUCN-Nepal, Kathamandu
	1.5 Extraction and storage methods for Medicinal Plants	2:00	1.6 *Lab work :* Herbarium preparation of MAPs	3	IUCN Nepal. 2004. Natioal Register of Medicinal Plants, IUCN-Nepal, Kathmandu.

	1.7 CITES and IUCN clauses and concept of threatened and endangered species	1:00			
	1.8 Regulations and marketing of MAPs in Nepal	1:00	1.9 *Field visit :* Identification of important medicinal plant products	2	SinghadarbarVaidyakhanaVikas Samiti(SDVKVS) .2004. Ayurvedic Products of SDVKS. Singhdarbar, Kathamandu, Nepal.
	1.10 Marketing of MAPs in Nepal, legal provision for management of MAPs in Nepal	1:00	1.11. *Field visit:* Identification of important aromatic plant products	2	Government of Nepal, Ministry of Industry, Commerce and Supplies, Trade and Export Promotion Center.
2. Uses of MAPs	2.1 Uses of medicinal plants in homeopathy, Naturopathy and ayurveda	1:00	2.2 *Field visit :* Documentation of local use of important medicinal plants in different tribal community	2	Atal, C.K. and B.M.Kapur.1982. Cultivation and Utilization of Medicinal and Aromatic Plants. Regional Research Laboratory, CSIR, Jambu-Tawi, India.
	2.3 Use of medicinal plants in Folk remedies and other traditional health care system	1:00	2.4 . *Field work :* Nursery preparation of MAP	2	Joshi, K. 2006. Documentation of medicinal Plants and their indigenous uses in Likhu sub watershed, Nepal, Journal of Non Timber Forest Product of Nepal, 11(2), 86-93.
	2.5 Use of medicinal and aromatic plant in organic agriculture production	1:00	2.6 . *Field work :* Demo plot establishment of MAPs	2	Barakoti, T.P. 2003. Cultivation of medicinal and aromatic plants in Nepal: An overview
3. Medicinal and Aromatic plants	3.1 Origin, distribution, description and chemical evaluation of neem(Azadirachtaindica)	1:00	3.2 . *Field observation* of herbal processing farms Medicinal	2	Ferlow, K. (2016). Neem: Nature's Healing Gift to Humanity, Neem Research (January 8, 2016)
	3.3 Origin, distribution, description and chemical evaluation of Aloe Vera	1:00	3.4 . *Field observation* of herbal processing farms Aromatic Plants	2	Brandon, B. (2015)The Everything Guide to Aloe Vera for Health: Discover the Natural Healing Power of Aloe Vera.

					Kindle Edition
			3.5 *Lab work :* Collection and processing of MAPs	3	
	3.6 Origin, distribution, description and chemical evaluation of Tulsi (Ocimum sanctum)	1	3.7 *Lab work :* Preparation of questionnaire designed for recording traditional uses of locally available herb/maps	2	Walton, A.A. 92021). OcimumBasilicum: Taxonomy, Cultivation and Uses, Kindle Edition
	3.8 Origin, distribution, description and chemical evaluation of Rose (Rosa indica)	1	3.9 *Field work :* Pre testing of questionnaire designed for recording traditional uses of locally available herbs/maps.	2	Sheff, E. (2018). Rose, https://www.herbrally.com/monographs/rose-es
	3.10 Origin, distribution, description and chemical evaluation of Mint (Mentha spp.)	1	3.*11Field work :* Establishment of Medicinal and Aromatic plant product unit APs	2	EU, 2019. European Union herbal monograph on Mentha x piperita L., aetheroleum. https://www.ema.europa.eu/en/documents/herbal-monograph/draft-european-union-herbal-monograph-mentha-x-piperita-l-aetheroleum-revision-1_en.pdf
	3.11 Origin, distribution, description and chemical evaluation of sweet flag (Acorus calamus)	1	3.12 *Focus group discussion :* Extension services for the promotion of MAPs	2	Panda, H. (2018). Herbal and Aromatic Plants - 34. Acoruscalamus (Sweet Flag), Discovery Publishing House Pvt Ltd
		16		32	

3.1 Syllabus Semester V

Course Code: OAG457 *Credit Hours:* 3:0 [Theory: 1.0; Practical: 2.0]

Course Title: Integrated Organic Agriculture *Teaching Hours:* 48:00

Course Description: Agriculture developmentin Nepal (from subsistent towards commercial). Specific features of hill/mountan agriculture and framing systems and their components.Component technologies in relation to biophysical and socioeconomic conditions.Integration of the components, past and present. Scope of and need for integration. Principles of integration in agriculture.Integration-the basis of organic agriculture.Integration of resourcesand their management; land, water crops, animals and others (*Jal*, *Jamin*, *Jangal*, *Janawar*, *Jadibuti* and *Janata*). Crop integration; cereal with legume and other crops.Crop-animal integration.Rice- duck-fish production system.Integrated poultry-pig-fish production.Agroforestry with various crops and livestock.Integrated Animal production system.Crop residue and animal waste management.Integrated soil nutrient management. Policies and strategies of integrated nutrient management, Integrated insect pest and disease management. Policies and strategies in pest and disease management in integrated organic agriculture.

*Course Objectives:*The general objective of this course is to impart the knowledge of organic agriculture through integrated approach. Specifically, this course aims to –

a. impart the knowledge on the basic concept of farming systems with their components based on Karnali.
b. be familiar with the principles, practices and need for resource integration in agricultural production
c. enable student to the management of crop, animal, soil, insect pests and diseases through integrated organic approach

Course Contents

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Teaching	Lecture Hours	Practical Elements of Learning	Practical Hours	

I	**Agricultural development in Nepalwith Specific features of Karnali**	1.1.Dynamism in agriculture in Nepal (example of Karnali) in response to changing socioeconomic conditions 1.3 Specificity of mountain (Karnali) agriculture 1.5 Farming systems in hill/mountainsand their components	3	1.2 *Observation and experience* :Discussion on the trend of agricultural development in Nepal and in Karnali: 1.4 *Writeshop:* Be familiar with mountain specificities: observation and experience 1.6 *Lab work :* Draw a figure depicting the interrelationship of the farming systems components	6	https://factsanddetails.com/south-asia/Nepal/Economics_and_Agriculture_Nepal/entry-7867.html ICIMOD (1994). Evolution of Mountain farming Systems. Proceedings of the FAO/ICIMOD Seminar. Various Publications of International Centre for Integrated Mountain Development (ICIMOD). HazemShawkyFouda (2121). Mountain Agriculture, P 243. Delve Publishing 224 Shoreacres Road, Burlington, ON L7L 2H2, Canada.

II	**Principles of resource integration in agriculture**	2.1. Resource integration in agriculture and its scope (Karnali example)	2	2.2.*Guided discussions:* Understanding the practical basis of resource integration in agriculture 2.3. *Group practice:*Preparation a integrated map of resources in Karnali farming systems	4	Amanullah, (2024). Integrated Agriculture: An Approach for Sustainable Agriculture, Berlin, Boston: De Gruyter, https://doi.org/10.1515/9783111448077 Tracex, 2024. 9 Principles of Integrated Farm Management Systems, https://tracextech.com/9-principles-of-integrated-farm-management-systems
III	**Organic agriculture and resourceintegration**	3.1.Organic agriculture and integrated approach in production: scope and context	1	3.2. *Group practice:* Preparation of broad integrated organic agriculture frame for the locality	3	Walia, S. S. and Kaur, T. (2024). Basics of Integrated Farming Panada, H. (2017). Integrated Organic Farming Handbook, Asia Pacific Systems, Springer
IV	**Crop-crop and crop-livestock integration**	4.1.Fundamentals ofcrop-crop-livestock integration in organic agriculture 4.3Poultry-Pig-fish –rice production system	1 1	4.2.*Discussion/ observation:* Practice of crop-crop-animal integration. 4.4 . *Lab work :* Design the field experiment on various integrated systems	2 2	Ghosh, B.(2007). Integrating Crops and Livestock, Gene-Tech Books https://books.google.com.np/books? Escribano A. J.(2021). Instant Insights: Integrated crop-livestock systems, Burleigh Dodds Science Publishing Limited, 82 High Street, Sawston,

						Cambridge CB22 3HJ UK Rajbhandari, B. (2010). Biointensive Farming and sustainable Livlihoods, WOREC, Kathmandu Various websites for typical research articlesrelated to the subject
V	**Integrated Animal Production system management**	5.1. Organic animal production and waste management farming system	1	5.2. Practice on managing animals in organic system in the farm	3	https://www.umass.edu/agriculture-food-environment/greenhouse-floriculture/greenhouse-best-management-practices-bmp-manual/organic-waste-management
VI	**Agroforestry**	6.1.Introduction to Agroforestry and its scope in Karnali agriculture	1	6.1.*Observation and Report Writing:* Available Agro-forestry systems in the locality	2	Mosquera-Losada, P.M.R. (2019). Agroforestry for sustainable agriculture, Burleigh Dodds Science Publishing, https://books.google.com.np/books?id=0CQzEQAAQBAJ KrishibanHatepustak (A Book on Agroforestry) - BhundipuranPrakashan Amatya, S. M. (1994). Agroforestry Systems and Practice in Nepal, Forest Research and Survey Centre,

VII	Soil management in integrated organic agriculture	7.1. Organic waste and soil health 7.3. Integrated/ organic nutrient management in major crops	1 2	7.2. *Field work :* Practice on preparing organic manures/fertilizers from various wastes 7.4. *Field work :* Practice on managing nutrients for major crops	2 3	Pradhan, S,(2015).Organic Farming for Improving Fertility of Soil, Today & Tomorrow's Printers and Publishers, New Delhi Panda, H.& D. Hota(2014).Biofertilizers and Organic Farming, Today & Tomorrow's Printers and Publishers, New Delhi Nehra, S. (2014).Biofertilizers for Sustainable Agriculture, Today & Tomorrow's Printers and Publishers, New Delhi Luxemburg, C.(2015). Handbook Of Composite Organic Farming, Today & Tomorrow's Printers and Publishers, New Delhi Smith, J. (2015). Handbook Of Organic Fertilizers: Types, Production And Impacts on Environment, Today & Tomorrow's Printers and Publishers, New Delhi Lingaraj, P. (2013). Organic Farming and Vermiculture, Today & Tomorrow's Printers and Publishers, New Delhi
VII	Pest management	8.1. Basic principles of		8.2.*Field work :* Practice on		Choudhary, A.

I	**in integrated organic agriculture**	organic pest management 8.3. Non-chemical pest management in in major crops	1 2	preparing organic pesticides from local materials 8.4. *Field work :* Practice on pest management for major crops	2 3	K.(2014).Organic Farming Biofertilizers and Biopesticides Technology, Singh, P. (2013).Biodiversity Based Organic Farming, Today & Tomorrow's Printers and Publishers, New Delhi Biswas, S. K. (2014).Organic Farming and Management of Biotic Stresses, Today & Tomorrow's Printers and Publishers, New Delhi Vacante, V. and S. Kreiter (2018). Handbook of Pest Management in Organic Farming, CABI Digital Library
Total hours of thematic teaching-learning			**16**	**Total hours of practical activities**	**32**	

Prepared by Khem Raj Dahal

Professor of Agronomy

Institute of agriculture and Anima Science, Kirtiour

3.1 Syllabus

Semester VI

Course Code: OAG466
Course Title: Human Nutrition and One Health Management

Credit Hours: 3:0 [Theory: 1.0; Practical: 2.0]
Teaching Hours: 48:00

Course Description: Basic concept of human nutrition and nourishment. Function of nutrients (Carbohydrates, fat and protein, Macro/ micronutrients and vitamins). Food digestion and absorption. Food habit and human health: lifecycle nutrition practices and diet modifications, 4H concept (head, heart, hand and health), vegetarian and non-vegetarian diets. Food and nutrition security: available food commodities (cultivated and wild) with their nutritional value. Holistic approach in agriculture and food production and from field to fork campaign. Food and animal health. Zoonosis and environmentally transmitted pathogens. Zoonotic diseases and their management. Food production and environmental health. Resources use, food safety and optimal nutrition. Economics of food production systems following the One Health approach. Food production and processing technologies for healthier andmore sustainable future.

Course Objectives: The general objective of this course is to impart the knowledge of agriculture production through integrated approach.

a. Impart the knowledge in basic concept of human nutrition through integrated 'one health' approach.
b. Understand the pathway of human nourishment through healthy, safe and nutritious food
c. Enable studentsto manage healthier food production systemfor safer environment and society

Course Contents:

Unit	Macro Level Contents	Micro Level Contents				
		Theoretical Elements of Learning	Lecture hours	Practical Elements of Learning	Practical hours	References
I	Basic concept of food and nutritionfrom environment and health perspective: one health approach	1.1.Nutritious and healthy food production with environmental considerations	1	1.2. *Group discussion :* Bringing the food and nutrition into discussion 1.3. *Review :* Relationship between food and environmental health: discussion and observation	2	Blank, FC (ed) 2013. A Handbook of Foods and Nutrition, Today & Tomorrow's Printers and Publishers, New Delhi 2. Behrens, P., Bosker, T and D. Erhardt (eds.) 2020. Food and Sustainability Illustrated Edition, Oxford Press.
II	Energy metabolism, digestion	2.1. Mechanisms of digestion and absorption of food and nutrients	3	2.2. *Group discussion :* Discuss the mechanism of digestion of common	7	1. Lal, Vandana (2013). AaharevanPoshan:

	&Absorption of nutrients and their functions	2.3. Energetic functions of foods: carbohydrates, fat and protein, 2.5. Role of minerals and vitamins human health and sustenance		foods 2.4. *Review :* Classify the common foods based on their digestibility and nutritive value 2.6. *Field visit :* Enumerate the status of nutritional deficiencyand symptoms prevailing in the locality 2.7. *Lab work:* analysis of common foods 2.3.1. carbohydrates 2.3.2. fats and Proteins 2.2.4. Minerals and vitamins		ShodhPravidhi (Research Methods in Food and Nutrition) 3. Grimble, G. (2017) The physiology of nutrient digestion and absorption, https://discovery.ucl.ac.uk/id/eprint/1575656/1/Grimble%202017.pdf 4. Miranda, J.M. (2020). Analytical Technology in Nutrition Analysis, MDPI.https://doi.org/10.3390/books978-3-03928-765-9
III	Food, and nutrition security: human health and dietary requirements and	3.1. Food and nutrition security: food type, consumption and human health 3.3. Lifecycle nutrition with 4H concept and diet modification 3.5. Food commodities, including wild and indigenous crops, in relation to health	3	3.2. *Field visit :* Discuss about the food and nutrition availability in the locality: whether secure 3.4. *Review :* Study the dietary pattern and in relation to the national recommended 3.6. *Group discussion :* Inspect yourself whether you are eating the needed diet: discuss among your friend and conclude1 3.7. *Review :* Identification of major commodities used for food and their nutritious status. 3.8. *Lab work :* Classify the food commodities based on their nutritional values (use result from the practical 2.4)	5	1.Watson, Z. (ed) 2022.Food and Nutrition: A Human Health Perspective, Murphy & Moore Publishing 2.Brown, J. (2024). Nutrition Through the Life Cycle, Cengage Learning, Inc | Brooks/Cole Andrew, L & K B Winton (2013). A Handbook of Structure and Composition of Foods Vol 2: Vegetables Legumes and Fruits/Winton, Today & Tomorrow's Printers and Publishers, New Delhi
IV	Holistic approach in food production consumption: from field to fork	4.1. Agriculture system, a holistic approach in production practice: from soil to the plate: indivisibleentity	1	4.2. *Review :* Understand agricultural production system as an entity composed of interrelated components. 4.3. *Group discussion :* Observe the nature of modern agriculture and food health issues 4.4. *Field visit :* Inspect and observe the fields and find differences	3	Chakraborty, R.,P. Mathur and and S. RoyRoy (eds) (2020). Food Production, Diversity, and Safety Under Climate Change, Springer) https://doi.org/10.1007/978-3-031-51647-4

				between the integrated organic and chemically fed fields crop products		
V	Diet-Related Cancers and Chronic Diseases	5.1. Relationship between diets and diseases	1	5.2 *Group discussion :* Collect information on the effect of diet on diseases and discuss among yourselves about your daily diet 5.3.*Field visit :* Study and enlist the established relationship between diet and disease with focus on junk foods and chatpate/panipuri, etc.	2	FAO/WHO (2003). Diet, Nutrition and the Prevention of Chronic Diseases, https://openknowledge.fao.org/server/api/core/bitstreams/198ee3d9-37f8-4fc4-a9d5-fb3317d8fc4e/content/ac911e.htm
VI	Animal--human-health -food nexus:Zoonotic diseases and their management	6.1. Animal health in relation to food products 6.3. Zoonotic diseases and human health 6.5. Management zoonotic diseases for food safety and human health	3	6.2 .*Field visit:* Enlist the common zoonotic diseases in the locality *6.4. Lab work:* Isolation of the pathogens of zoonotic diseases and understand ecology 6.6. *Lab work:* Understand the ecology of such pathogens *6.7. Field work :* Observe the diseased animals and their behavior with people suffered with such diseases 6.8. *Field work :* Make the practical action plan and work for managing zoonotic diseases	5	1. Sato, M. P. Adsakwattana and I. Kendrich Fontanilla (eds.) (2020). Zoonotic Diseases and One Health, MDPI. https://doi.org/10.3390/books978-3-03928-011-7 2. Gremmels, J F (ed) 2012. Animal Feed Contamination: Effects on Livestock and Food Safety,
VII	One health approach in resources use, food safety and optimal nutrition	7.1. One health concept and efficient resource management for safe food and optimal nutrition: Soil-plant-animal-food nexus	1	7.2.*Group discussion :* Understanding the ecology and health of soils 7.3. *Field work :* Practices for managing healthier soils 7.4.*Group discussion :* Raising healthier animals through healthier feed 7.5. *Field work :*Establish an integrated farm production system following one heath approach	4	1.Improving Food Safety Through a One Health Approach: Workshop Summary, https://www.ncbi.nlm.nih.gov/books/NBK114498/ 2.Dash, Gyanindra et al (2014) Sustainable Agriculture and Food Security, Today & Tomorrow's Printers and Publishers , New Delhi

VIII	Food production and environment for healthier and sustainable future	8.1. Healthy and safe food production system for sustainable future and healthy society: issues of food contamination and poisoning 8.3. Post-harvest and food processing: adulteration and contamination 8.5. Economics of one health approach in food production	3	8.2. *Group discussion :* Study the feasibility of the application of one health approach in Nepalese agriculture 8.4.*Group work :* Study the food production-market-consumption and their status in the locality and analyze their potential 8.6 *Observations :* Study the food safety status in the local markets 8.7. *Field visit :* Visit the food processing factories and assess their safety level	4	1. Schrenk, D.(ed) (2012) Chemical Contaminants and Residues in Food, Today & Tomorrow's Printers and Publishers, New Delhi 2.Ek- SwasthyaRananiti, 2076 Nepal, https://moald.gov.np/content/32/one-health-strategy--2076/ 3. Kumar, R S. (2012). Agri Food Crops: Processing Value Addition Packaging and storage 5. Tripathi, M K & S Mangaraj (2013) Advances in Food Processing Technology.
			16		32	

Prepared by Khem Raj Dahal
Professor of Agronomy
Institute of agriculture and Anima Science, Kirtiour

3.1 Syllabus

Semester VII

Course Code: OAG475 *Credit Hours:* 2:0 [Theory: 1.0; Practical: 1.0]

Course Title: Organic accreditation and certification *Teaching Hours:* 32:00

Course Description: Organic production in terms of practices. Status of organic production in Nepal and in Karnali. Present status of National and international market of organic products.Linking producers and consumers with organic products.Quality issues and trustonlocal organic production. Need for certification and accreditation. Standards ascribed to organic products. Quality issues of organic products.IFIOAM and organic standards.Codex Alimentarious and its Guidelines.International organic standards (Europe, Japan and USA).National Standards for Organic Production (NSOP), Commonalities and differences among the variousstandards, Accreditation and Certificationwith theirType.Steps of certification and its procedures.Internal control system ICS, Participatory Guarantee System (PGS), Constraints to organiccertification in Nepal. International certification agencies in Nepal, National Certification agency (OCN), Exports of organic products (food and others) from Nepal.Future scope and market of products in Nepal. Sustainability issues in organic production systems in Nepal.

Course Objectives: The general objective of this course is to impart the knowledge of integrated production of crops and animals. More specifically this course aims to

a. impart the knowledge on basic concept of quality control system and certification of organic production
b. Make the students familiar with various national and internal standards
c. enable student to be well equipped with organic accreditation and certification and processes and agencies

Course Contents:

Unit	Macro Level Contents	Micro Level Contents				
		Theoretical Elements of Learning	Lecture hours	Practical Elements of Learning	Practical hours	References
I	What and how organic? practices and products in Nepal	1.1.Organic agriculturalpracticesin Nepal and principles of organic agriculture	1	1.2 *Discussion:* on what is organic and what not based on observation and desk review 1.3 *Discussion :* List the organic production systems and products with their niche	2	Newspapers and periodicals in the subject matters Commodity wise information published in newspapers and periodicals
II	Marketing andquality issues of organic products	2.1. Organic Products in Nepal: local and international market 2.3 Quality issues of Nepalese organic products	2	2.2.*Field visit*: List the organic products availability in the locality and discuss about their quality issue 2.4. *Lab work* on and proximate analysis of organic product and	5	Geholt D. (2019). Organic Farming: Standards, Accreditation, Certification and Inspection, 1st Edition. M/s Agribios publisher,

				pesticide residue		ISBN-13-978-8177542370
III	Organic Certification: need and utility	3.1. Introduction to organic certification systems. 3.3. Certification practices: national and international levels	2	3.2. *Group discussion:* Discussion and internalization of the need for certification 3.4. *Review :*List the certification practices available in Nepal	2	Publications of IOAM and Organic International
IV	Organic standards: International and National	4.1. Basic understanding of standard and International Regulatory Guidelines 4.3. IFOAMguidelines and Codex Alimentarious. 4.5. Special features of European, American, Japanese, and others available standards and guidelines 4.7. Nepal's organic standard	4	4.2. *Review :*Be familiar with the concept of organic standard in Nepalese context. 4.4. *Review :* List out the important features of IFOAM standard and Codex Alimentarious 4.6. *Discussion :* Discus their applicability in Nepalese context 4.8. *Review :* Basic features of European and American organic standards 4.9. *Review :* Basic features of Asian and other standards 4.10. *Group discussion :* Basic features of Nepali standard 4.11. *Review :* Organic standard in Nepal: Commonalities and differences with international standards 4.12 . *Review :* Study of the Karnali Province Organic Agriculture Act (2076) and discuss its basic features	8	Regulation (Eu) 2018/848 of The European Parliament and of The Council https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32018R0848#d1e32-56-1 and websites of concerned agencies ANSAB (2022). Organic Farming Practices: A Toolkit for facilitators to build capacity of farmers with special emphasis on inputs preparation and application in organic farming, Karnali Organic Krishi Bisesank, 2076/77
V	Organic Certification in Nepal	5.1. Organic production, producer-consumers nexus and certification 5.3. Local market and scope of truthful labeling 5.5. Organic Certification Nepal (OCN)and its working sphere 5.7. Third Party certification: Certification of product and farm. 5.9. International certification agencies working in Nepal and their sphere	4	5.2 . *Group discussion :*Discuss the concept safe food and their source: how is the food produced. 5.4 .*Discussion :* Understanding certification type and procedures 5.6. *Field visit :*Be familiar with the certification of farms and products 5.8.*Field visit:* Get involved in national organic certification system and take part in it	14	Hajra, N G (2014). Manual for Organic Farming: A Comprehensive Guide to Start and Run on Organic Farm Singh A K (2011). Conversion to Organic Agriculture Documents and publications of OCN

				5.10. *Group discussion :* Get acquainted with international certification agencies working in Nepal 5.11. *Field work :* Design an organic farm and initiate the process and its certification 5.12 . *Field work :* Register the farm and follow the procedure of conversion 5.13. *Lab work:* Keep record of the activities and with compliance 5.14. *Lab work :* Prepare of a group report of the work be able to work individually. 5.15. *Field visit :* Visit the organic farms available in the locality: observation 5.16. *Group discussion :* Interact with organic growers and prepare report		Procedures of : https://ocn.com.np/, Websites of OCN and Nep.cert (https://nepcert.org/)
VI	Accreditation	6.1. Accreditation and its procedure in Nepal- Nepal Accreditation Body (NAB)	1	6.2. *Review :* Study the basic features of Nepalese Accreditation system 6.3. *Review :* Be familiar with the procedure in and discuss its compliance to organic certification process	2	Government document on Accreditation Procedure
VII	Prospects of Nepalese organic production and marketing: sustainability	7.1. Sustainability of Nepalese agriculture and of organic production system 7.3. Scope and issues of sustainability of organic farming/products and their marketing in Nepal	2	7.2. *Review :* List the indicators of sustainability in agriculture. 7.4. *Group discussion :* Chalk out the opportunities and limitations of certification and marketing: specific to common organic commodity/lies in the locality.	2	Wezel, A. (2017). Agroecological Practices For Sustainable Agriculture: Principles, Applications, And Making The Transition Commodity wise publications in newspapers and periodicals
			16		32	

Prepared by Khem Raj Dahal
Professor of Agronomy
Institute of agriculture and Anima Science, Kirtiour

3.1 Syllabus

Semester II

Course Code: PPT428

Course Title: Principles of Plant Protection

Credit Hours: 3:0 [Theory: 1.0; Practical: 2.0]

Teaching Hours: 48:00

Course Description: Plant protection: Abiotic factors (disorders and deficiencies), Biotic factors: Insect pests , Plant pathogens/microorganisms: Fungi, bacteria, virus, nematodes; Weeds, Rodents, and Non-human Primates, Entomology.; Definition of insects and entomology, characteristics of insects, Insect life cycle and types of metamorphosis, Classification of insect: major insect orders and families, natural enemies of the insects: Predators andparasitoids; Plant pathology and Pathogens, Meaning of diseases and its symptoms; Blight, Galls, Cankers, Leaf spot, Leaf curl, Mildews, Rots, Rusts, Wilts, Classification of disease : infectious and non-infectious, Disease cycle, Introduction to plant pathogens : Bacteria, fungus, virus, nematodes, Factors of disease development and plant disease epidemiology, Factors of disease development and plant disease epidemiology, Weed Science and weeds, Definition and characteristics of weed, types of weeds, Effect of weeds on crop production, weed seed banks, Weed Management: preventive and curative methods, Importance of weeds/ Advantages/benefits Rodents and Non-human primates; Definition, identification, characteristics and Economic Importance of Rodents and Non-human Primates.

Course Objectives:

After completion of this course students will be

a. acquainted with the basic concepts of insect pests, diseases, weeds and their management
b. able to identify insect pests, diseases, weeds and vertebrate pests and their management
c. acquainted with different plant pathogens, diseases, weeds and vertebrate pests (rodents and non-human primates).

Course Contents:

Unit	Macro Level Contents	Micro Level Contents				
		Theoretical Elements of Learning	Lecture hours	Practical Elements of Learning	Practical hours	References
I	Basic concept and terminologies of plant protection	1.1 Plant protection: Abiotic factors (Disorders and deficiencies) and Biotic factors, Insect pests, Diseases, Pathogens, Weeds, Rodents, Non-human Primates, Pesticides, Entomology, Pathology.	1	1.2 *Lab work :* Study of general morphology of insects	1	Triplehorn, C. A., Johnson, N. F.&Borror D. J. 2005. Borror and DeLong's Introduction to the Study of Insects (7th edition: illustrated and reprint). Thompson Brooks
II	Insect pests	2.1 Definition and characteristics of insects	1			Richards, O. W. 2012. IMMS general textbook of entomology

Min Raj Pokhrel, PhD (External expert)

						(Editors: A.D. Imms, O.W. Richards, R.G. Davies) Springer Netherlands.
		2.2 nsect life cycle and metamorphosis	1	2.3 *Lab work:* Identification of major insect orders	1	Richards, O. W. 2012. IMMS general textbook of entomology (Editors: A.D. Imms, O.W. Richards, R.G. Davies) Springer Netherlands.
		2.4 Classification of insect: major orders and their families	1	2.5 *Lab work :* Study of life cycle of holometabolous insects	1	Triplehorn, C. A., Johnson, N. F.&Borror D. J. 2005. Borror and DeLong's Introduction to the Study of Insects (7th edition: illustrated and reprint). Thompson Brooks
		2.6 Insects as bio-control agents: Predators and parasitoids	1	2.7 *Lab work:* Study of life cycle of hemimetabolous insects	1	Pedigo, L.P. 2009. Entomology and Pest Management, PHI Learning Private Limited, , ISBN-978-81-203-3886-9
				2.8 *Field work:* Collection and Identification of major insect predators	1	Sathe, T. V. and Patel, V. 2003. Insect predators in pest management. Daya Publishing House.
				2.9 *Field work:* Collection and Identification of major parasitoids	1	Godfray, H. C. J. 1994. Parasitoids: Behavioral and Evolutionary Ecology. Princeton University Press.
				2.10 *Group discussion:* Study of integrated pest management methods	1	Pedigo, L.P. 2009. Entomology and Pest Management, PHI Learning Private Limited, , ISBN-978-81-203-3886-9
III	Plant diseases	3.1 Meaning of diseases and their symptoms: Blight, Galls, Cankers, Leaf spot, Leaf curl, Mildews, Rots, Rusts, Wilts	1	3.2 *Field visit:* General study of common diseases symptoms	1	Singh R. S. 1999. Introduction to Principles of Plant Pathology. Oxford and IBH Publishing Pvt. Ltd., New Delhi.

Min Raj Pokhrel, PhD (External expert)

		3.3 Classification of disease: infectious and non-infectious	1	3.4 Collection and Identification of the major diseases of cereals	1	Sinha, H. K. 2003. A textbook of plant diseases. Centrum Press.
		3.5 Introduction to plant pathogens: Bacteria, fungi, virus, nematodes	1	3.6 Collection and Identification the major diseases of vegetables	1	Chaube H. S and Singh R. 2017. Introductory Plant Pathology. CBS Publishers and Distributors Pvt Ltd.
		3.7 Plant disease cycle	1	3.8 Collection and Identification of the major diseases of fruits	1	Singh, R. S. 2017. Introduction to Principles of plant pathology (5th edition). CBS Publishers & Distributors Pvt Ltd, India
		3.9 Factors of disease development and plant disease epidemiology	1	3.10 Preparation of disease herbarium and disease identification	1	Strange, R. N. 2002. Introduction to plant pathology. Wiley.
				3.11 Practice of different methods of pesticide application		Dwivedi, O. P. 2002. Plant Pathology: Introduction & Principle
				3.12 Preparation and application of Bordeaux Mixture	1	Singh, R. S. 2017. Introduction to Principles of plant pathology (5th edition). CBS Publishers & Distributors Pvt Ltd, India
				3.13 Visit to input supplier to identify/acquainted with different pesticides sold in Nepal	1	
IV	Weeds	4.1 Definition of weed and weed seed bank, types of weeds, Effect of weed on crop production	1	4.2 Collection/identification of major weeds and weed herbarium preparation	1	Zimdahl, R. L. and Basinger, N. T. 2024. Fundamental of weed science (6th edition). Academic Press.
		4.3 Major weeds in different crops in Nepal	1			
		4.4 Weed Management: preventive and curative methods	1			Monaco, T. J. , Weller, S. C. and Ashton, F. M. 2002. Weed science: principles and practices (4th edition). John Wiley and Sons, Inc.

Min Raj Pokhrel, PhD (External expert)

		5.1 Major insect pests and diseases prevalent in Karnali province	1	5.2 Study of plant protection appliances used in Karnali province	1	
		5.3 Major vertebrate pests (rodents and non-human primates) prevalent in Karnali province	1	5.4 Study of vertebrate pests (rodents and non-human primates) in Karnali province	1	
V	Plant protection	5.5 Indigenous type of plant protection measure practices in districts of Karnali province	1	5.6 Collection and Identification of pesticidal plants prevalent in Karnali Province	1	
			16:00		32:00	

Min Raj Pokhrel, PhD (External expert)

3.1 SyHabus

Semester III

Course Code: PPT438 *Credit Hours:* 3:0 [Theory: 1.0; Practical: 2.0]

Course Title: Crop Pestsand Integrated Pest Management (IPM) *Teaching Hours*: 48:00

Course Description: This course includes the theoretical and practical aspects of IPM and its strategies; IPM tactics-pest, plant and environment manipulation, Pest management decision levels; Economic decision levels for pest populations, Economic damage and the damage boundary, Economic threshold level and economic injury level, Calculation of economic decision levels in pest management, IPM Strategies; Physical, Mechanical, Cultural, Legislative and Biological methods of pest management, Host plant resistance, Innovative method, IPM field school and holistic pest management (HPM) methods, Crop Pests; Identification and integrated management of insect pests of cereals, vegetables, fruits, grain legumes, industrial crops and storage grains .

Course Objectives: The general objective of this course is to impart the knowledge of insect pest of cereal, vegetables, and fruits crops with their integrated management practices. More specifically this course aims to

a. Impart the knowledge in basic concept of economic decision levels, IPM/HPM tactics and strategies,
b. enable students in identificationof the major insect pest of cereals, vegetables, fruits, and storage conditions, and
c. enable student to demonstrate and implement pest management practices.

Course Contents:

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learing	Lecture hours	Practical Elements of Learning	Practical hours	
I	Basic concepts of IPM and their strategies	1.1 IPM tactics: pest manipulation, plant manipulation, environmental manipulation	1:00	1.2 *Lab work* : Familiarization of IPM tools available in GSAF plant protection lab and adjoining farmers field	1:00	Dhaliwal, G. S & R. Arora. (2001). Integrated Pest Management- Concepts and Approaches, Kalyani Publisher, New Delhi, India. Third Edition, 2016, Reprinted, 2022. ISBN: 978-93-272-6315-2
		1.3Basic Strategies of IPM		1.4 *Group discussion* : Study of practices of pest manipulation, plant manipulation and environment manipulation	2:00	
II	Concepts of pest management decisions	2.1 Economic decision level assessment tools: Monitoring, survey and surveillance	2:00	2.2 *Field work*: Monitoring of insect pests using pheromone traps.	1:00	
		2.3 Concepts of threshold levels for pest management decisions		2.4 *Field work:* Monitoring of insect pests using various sticky traps.	1:00	

Min Raj Pokhrel, PhD (External expert)

		2.5 Significance of decision level in pest management		2.6*Field work*: Monitoring of insect pests using light traps	1:00	
III	IPM strategies	3.1 Physical methods	4:00	3.2*Field work*: Documentation of physical methods of pest management used in farmers' field	2:00	Pedigo, L.P. (2009). Entomology and Pest Management, PHI Learning Private Limited, , ISBN-978-81-203-3886-9
		3.3 Mechanical methods		3.4 *Field work*: Documentation of mechanical methods of pest management used in farmers' fields	2:00	Flint, M.L. (2012). IPM in Practice; Principles and Practices of Integrated Pest Management, 2nd Edition, University of California, Publication.
		3.5 Cultural methods		3.6 *Field work*: Documentation of cultural methods of pest management used in farmers' fields	2:00	Pedigo, L.P. (2009). Entomology and Pest Management, PHI Learning Private Limited, , ISBN-978-81-203-3886-9
		3.7 Legislative methods		3.8 *Field work*: Collection and identification of common predators and parasitoids	1:00	
		3.9 Biological methods		3.10 *Field work*: Methods of bio pesticides (entomopathogenic fungus, bacteria, virus and nematodes) application methods for crop pest management	2:00	Neupane, F.P. (2000) JaibikBidhidwara Kira Niyantran (In Nepali), SajhaPrakashan
		3.11 Host plant resistance		3.12 *Field work*: Study of host plant resistance characteristics in crop plants	2:00	L.P. Pedigo, Entomology and Pest Management. (2009) 6th Edition, ISBN-978-81-203-3886-9, PHI Learning Private Limited.
		3.13 Chemical methods		3.14 *Group work*: Formulation, calibration and calculation of chemical pesticides	2:00	
		3.15 Innovative methods		3.16 *Field work*: Study of innovative practices of insect pest management	2:00	

Min Raj Pokhrel, PhD (External expert)

		3.17 IPM field school		3.18 *Field work*: Conduction of IPM farmers field school	2:00	PPD. (2002). IPM farmers field school in Nepal: A step towards sustainable livelihood. A concept paper. National IPM Unit, PPD, Lalitpur, Nepal.
IV	Crop Pests	4.1Integrated and holistic pest management methods	2:00	4.2*Field work*: Collection and identification of insect pest of cereals	2:00	Neupane, F.P. (2000). Bali biruwakasatruratinkoroktham(In Nepali) 4th edition, SajhaPrakashan
		4.3Integrated management of vegetable pests	2:00	4.4 *Field work*: Collection and identification of insect pest of vegetables	2:00	Aggarwal, B.S. (2017), Pest Control in Gardening Plants, Vinod Kumar Jain, Scientific International (Pvt)Ltd. ISBN: 987-93-84007-89-8
		4.5 Insect pest of fruits and their integrated management	2:00	4.6 *Field work*: Collection and identification of insect pest of fruit crops	1:00	
		4.7 Insect pests of grain legumes and oilseeds and their management	1:00	4.8 *Field work*: Collection and identification of insect pests of grain legumes and oil seeds	2:00	Neupane, F.P. (2000). Bali biruwakasatruratinkoroktham(In Nepali) 4th edition, SajhaPrakashan
		4.9 Insect pests of industrial crops, spices and condiments and their management	1:00	4.10 *Field work*: Collection and identification of insect pests of industrial crops, spices and condiments	1:00	
		4.11 Storage grain insect pests and their integrated management	1:00	4.12 *Field work*: Collection and identification of insect pests of storage	1:00	Bhargava, M.C.&Kumawat K.C. (2019). Pests of Stored Grains and Their Management. ISBN: 9789387973671 Crop Pest and Stored Grain Pest and Their Management, Agrimoon.com
			16.00		32.00	

Min Raj Pokhrel, PhD (External expert)

3.1 Syllabus

Semester VI

Course Code: PPT467 *Credit Hours:* 3:0 [Theory: 1.0; Practical: 2.0]

Course Title: Industrial entomology and mushroom cultivation *Teaching Hours:* 48:00

Course Description: Definition, history, importance and scope of industrial entomology, Apiculture , honey bee caste, biology and behavior, Major honey bee species: Exotic and indigenous, Morphology of bee species,Bee keeping technology, Sericulture;Definition history,scope and importance, Silkworm rearing technology, Silkworm insect pest and diseases and their management, Lac culture;Lac insect rearing and lac production technology, Commercial insect predators and parasitoids; Commercial scavengers: black soldier fly, dung beetles; Pollinators and commercially exploited pollinators, Entomotourism, apitourism and aesthetic insects, Mushroom; introduction , scope and importance, Cultivated and wild mushroom species of Nepal, Pure culture and spawn production, Mushroom cultivation practices

Course Objectives: The general objective of this course is to impart the knowledge rearing and management of industrial insect and mushroom cultivation. More specifically this course aims to

a. impart the knowledge in conventionalindustrial insects
b. enable student in understanding non-conventional industrial insects such as bio-control agents, scavengers and pollinators.
c. enable student in production practices of mushroom

Course Contents:

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture hours	Practical Elements of Learning	Practical hours	
I	Industrial entomology: apiculture, sericulture and lac	1.1 Definition, history, scope and importance	1:00	1.2 *Labwork:* Conventional and non-conventional insect products: bee hive and honey bee products, lac, silk, entoceuticals, food and feed	1:00	R.C. Neupane& Sharma A. 2076. Apiculture, Sericulture and Mushroom Cultivation, Heritage publication and distributors Pvt.Ltd.

Min Raj Pokhrel, PhD (External expert)

	culture					Omkar. (Editor) 2017. Industrial Entomology. Springer Publication
		1.3 Honey bee caste, biology and behavior	1:00	1.4 *Group work*: Honey bee castes and their lifecycle	1	Shukla A.N. 2000, Beekeeping Trainers Resource Book, ICIMOD
		1.5 Major honey bee species: Exotic and indigenous	1:00	1.6.*Lab work:* Morphological specialties in *Apisflorea, A. cerana, A. mellifera, A. dorsata/laboriosa*	2:00	Omkar. (Editor) 2017. Industrial Entomology. Springer Publication
		1.7 Morphology of special appendages in honey bees	1:00	1.8.*Lab work:* Dissection of mouthparts, legs and stinger in honey bees 1.9 *Lab work*: Preparation of artificial feed for offseason	2:00	Wu J, Yan S, Zhao J, Ye Y (2014) Barbs Facilitate the Helical Penetration of Honeybee (*Apismelliferaligustica*) Stingers. PLoS ONE 9(8): e103823.
		1.10 Bee keeping technology	1:00	Lab work/apiary visit 1.11 Bee hives, tools and equipment used in beekeeping 1.12Apiary/ beehives : Queen production and technique of dequeening and dequeening Artificial feeding: energy and protein supplements and substitutes	2:00 1:00	Basic beekeeping trainer's manual, ICIMOD
				A trek across a transect 1.13 Identification and management of bee forage' pollen and nectar sources	1:00	Uma Pratap. 1997. Bee flora of Hindukush Himalayans: Inventory and management. ICIMOD, Kathmandu

	culture					Omkar. (Editor) 2017. Industrial Entomology. Springer Publication
		1.3 Honey bee caste, biology and behavior	1:00	1.4 *Group work*: Honey bee castes and their lifecycle	1	Shukla A.N. 2000, Beekeeping Trainers Resource Book, ICIMOD
		1.5 Major honey bee species: Exotic and indigenous	1:00	1.6.*Lab work:* Morphological specialties in *Apisflorea, A. cerana, A. mellifera, A. dorsata/laboriosa*	2:00	Omkar. (Editor) 2017. Industrial Entomology. Springer Publication
		1.7 Morphology of special appendages in honey bees	1:00	1.8.*Lab work:* Dissection of mouthparts, legs and stinger in honey bees 1.9 *Lab work*: Preparation of artificial feed for offseason	2:00	Wu J, Yan S, Zhao J, Ye Y (2014) Barbs Facilitate the Helical Penetration of Honeybee (*Apismelliferaligustica*) Stingers. PLoS ONE 9(8): e103823.
		1.10 Bee keeping technology	1:00	Lab work/apiary visit 1.11 Bee hives, tools and equipment used in beekeeping 1.12Apiary/ beehives : Queen production and technique of dequeening and dequeening Artificial feeding: energy and protein supplements and substitutes	2:00 1:00	Basic beekeeping trainer's manual, ICIMOD
				A trek across a transect 1.13 Identification and management of bee forage: pollen and nectar sources (major, medium and minor sources), propolis sources	1:00	Uma Pratap. 1997. Bee flora of Hindukush Himalayans: Inventory and management. ICIMOD, Kathmandu Beekeeping Directory, 2072 Beekeeping Directory, 2072
				Apiary/beekeeper visit 1.14 Bee colony transfer and hive	2:00	Basic beekeeping trainers manual, ICIMOD

Min Raj Pokhrel, PhD (External expert)

				transportation		
				Apiary visit 1.15 Honey harvesting, processing and preservation	2:00	Beekeeping Directory, 2072
		1.16 Insect pests, diseases and pesticide poisoning in honey bees	1:00	1.17 Insect pests and diseases of honey bees and pesticide poisoning symptoms	2:00	Arbol. Year. A book on Honeybee diseases. Publisher Robert Owen. 2022. Honeybee pests and diseases, a complete guide to prevention and management.
II	Sericulture	2.1 Definition, history , scope, importance and challenges	1:00	Specimen collection/preservation 2.2 Silkworm life cycle and seri products	1:00	Author. Year. A text book of sericulture. Publisher.
		2.3 Silkworm rearing technology	1:00	2.4 *visit :* Serifarm excursion	2:00	Author. Year. A text book of sericulture. Publisher.
				2.5 Silkworm rearing ecosystem management	2:00	
		2.6 Insect pests and diseases of silkworm and their management	1:00	Specimen Collection/preservation 2.7 Insect pests and diseases of silkworm	2:00	Author. Year. A text book of sericulture. Publisher.
III	Lac culture	3.1 Lac insect and lac production technology	1:00	*Field practical:* 3.2 Lac rearing and production in host plants	1:00	Author. Year. A text book of sericulture. Publisher.
IV	Predators and parasitoids	4.1 Commercial insect pest bio-control agents: predators and parasitoids	1:00	Identification of major predatory insects Identification of major parasitoids	2:00	
	Insect pollinators and pollination	4,1 Pollinators and commercial pollinators, pollinators in agriculture production and biodiversity conservation	1:00	*Field observation:* 4.2 Visit agricultural landscape to identify pollinators	2:00	Arizona Bee Identification Guide Lisa Mason, Brooke Sayre-Chavez, Colton O'Brien, and Arathi Seshadri. A Beginner's Field Guide to Identifying Bees. Colorado State University. NativeBeeWatch.org
		4.3 Solitary bees and biodiversity of other pollinators	1:00	*Assignment/case study:* 4.4 Assignment on solitary bees and other pollinators	2:00	Bee identification guide of (www.pollinator.org/ www.epri.com)

Min Raj Pokhrel, PhD (External expert)

V	Mushroom production technology	5.1 Introduction, scope, opportunities and challenges of mushroom cultivation.	1:00	5.2. *Lab based*: Pure culture preparation and spawn production	2:00	BISWAS, S., Datta, M., &Ngachan, S. V. (2011). *Mushrooms: A Manual for cultivation*. PHI Learning Pvt. Ltd.. Shrestha, J. B. (2014). Present scenario and prospects of mushroom cultivation in Nepal. *The Status of Collection and Utilization of Nepalese Mycobiota*, 23.
		5.3 Mushroom species (Oyster mushroom, button mushroom, milky mushroom) and their cultivation	2:00	5.4.*Project work*: Mushroom production practices	1:00	Prasad, D., & Singh, R. (2020). Diseases, moulds, insect-pests and mites of mushroom.
		5.5 Mushroom pests and diseases and their management s	1:00	5.6.*Field visit*: Collection, identification and preservation of cultivated wild edible and poisonous mushroom in Nepal	1:00	Raut, J. K. (2019). Current status, challenges and prospects of mushroom industry in Nepal. *International Journal of Agricultural Economics*, *4*(4), 154-160. Pokhrel, C. P. (2016). Cultivation of oyster mushroom: A sustainable approach of rural development in Nepal. *Journal of Institute of Science and Technology*, *21*(1), 56-60.
			16:00		**32:00**	

Min Raj Pokhrel, PhD (External expert)

3.1 Syllabus

Semester VII

Course Code: PPT4 *Credit Hours:* 2:0 [Theory: 1.0; Practical: 1.0]

Course Title: Crop Diseases and Management *Teaching Hours:* 32:00

Course Description: Major diseases of rice and their management, Major diseases of maize and their management, Major diseases of wheat and their management, Major diseases of minor cereal crops (Finger millet, Buckwheat, Barley) Major Diseases of vegetables and spice crops and their management; Diseases of legumes and their management, Diseases of fruit and industrial crops and their management,

Course objectives:The general objective of this course is to impart the knowledge of crop diseases and their management. More specifically this course aims to

a. Impart the knowledge in major diseases of cereal crops and their management
b. impart the knowledge in major diseases of vegetable and spice crops and their management
c. impart the knowledge in major diseases of legume crops and their management

Course Contents:

Unit	Macro Level Contents	Micro Level Contents				References
		Theoretical Elements of Learning	Lecture hours	Practical Elements of Learning	Practical hours	
I	Economic importance of cereal crop diseases and their management	1.1 Major diseases of rice and their management (Rice Blast, Brown spot, Sheath Blight, Bacterial leaf blight, False smut, Foot rot, Root knot nematode	2	1.2 *Field visit :* Field visit for the identification of biotic and abiotic factors causing plant disease	1	H.S. Chube and V.S. Pundhir, Crop Disease and Their Management
		1.3 Major diseases of maize and their management (Northern leaf blight and Southern leaf blight of maize, Banded leaf and sheath blight, Grey leaf spot, Fungal and bacterial stalk rot, Ear rot	2	1.4 *Field and lab work :* Collection, Identification and Preservation of disease specimen	2	Gupta, V. K., & Paul, Y. S. (2002). *Diseases of field crops*. Indus Publishing. Manandhar H.K. 2016, A field guide for identification and scoring methods of diseases in the mountain crops of Nepal, Biodiversity international

LaxmanAryal
NARC, Bhairahawa

		1.5 Major diseases of wheat and minor cereal crops and their management (Wheat Rust, Helminthosporium leaf blight of wheat, loose smut, Powdery mildew of wheat, Blast of fingermillet, Powdery mildew of buckwheat, rust of barley	2	1.6 *Lab work :* Teasing of disease sample and identification of causal organism	1	G. Dahal, P.Amatya and H.K. Manandhar, 1992, Review of Plant Pathology
II	Economic importance of vegetable and spice crop diseases and their management	2.1 Major diseases of cruciferand their management (Club root, Black rot, Downy mildew, Damping off of seedling, Alternaria leaf spot/ Blight, White rust)	1	2.2 *Lab work :* Tranverse section cutting of disease sample to study host-pathogen relationship	2	N. Pradeep, S. Kautish and C.R. Nirmala, 2019. Modern Technique for Agriculture Disease Management and Crop Yield Protection
		2.3 Major Diseases of cucurbits and their management (Powdery mildew, Downy mildew, Damping off, Gummy stem blight of bottle guard, Fungal wilt, Bacterial wilt, Root knot nematode, Cucumber mosaic	1	2.4 *Lab work :* Ooze test for bacterial infection	1	Singh, R. S. (2001). *Plant disease management* (pp. viii-+). New Hamshire: Science Publishers.
		2.5 Major diseases of solanaceous crops and their management (Late blight of potato and tomato, Early blight of potato/ tomato, Phytophthora blight of capsicum, Sclerotinia stem rot/white mold/blossom blight of solanaceous crop, Bacterial wilt of tomato, Root knot nematode tomato Little leaf of brinjal/chilly, Tomato leaf curl	1	2.6 *Lab work :* Extraction of different stages of Nematodes	1	Chaube, H. S., &Pundhir, V. S. (2005). *Crop diseases and their management*. PHI Learning Pvt. Ltd..
		2.7 Major diseases of spice crops and their management (Ghizome rot of zinger, Rhizome rot of large cardamom, Chirky and foorkey disease of large cardamom, Stemphylium blight of garlic/onion, Purple blotch of onion	1	2.8 *Lab work :* Microscopic slide preparation of fungi	2	
III	Economic importance of legume crop diseases	3.1 Major diseases of legume crops and their management (Stemphylium blight of	2	3.2 *Lab work :* Dilution of chemicals &	3	Saharan, G. S., Mehta, N., &Sangwan, M. S.

LaxmanAryal
NARC, Bhairahawa