

FAR WESTERN UNIVERSITY
Faculty of Agriculture
Undergraduate Program in Agriculture
Science



Sixth Semester Syllabus

B. Sc. Agriculture Science Sixth Semester Syllabus

S.N.	Name of the Course	Course Code	CH-Th	CH-Pr	CH-Total	Reference Page
1	Agricultural Communication	AEX611	1	1	2	
2	Agricultural Statistics and Computer Technology	AST621	2	1	3	
3	Advanced Agronomy, Biodiversity Conservation and NUS	AGR621	2	1	3	
4	Farm Structure and Survey	AEN611	1	1	2	
5	Fundamentals of Dairy Science and Technology	ASC621	2	1	3	
6	Industrial Entomology	ENT611	1	1	2	
7	Project Planning and Evaluation	AEC621	2	1	3	
8	Protected Horticulture	HRT611	1	1	2	
9	Mushroom Cultivation	PPA601	0	1	1	
10	Agri-Enterprise Learning and Development	AED601	0	1	1	
Total			12	10	22	

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Course Code	AEX611
Course Title	Agricultural Communication
Credit Hours	2 (1+1)
Full Marks	50
Theory (Marks)	25
Practical (Marks)	25

Objective (s) of the Course
Upon the completion of this course, the students will be able to understand the basic concept of communication, their principle, method, type, system and media preparation etc. and this course will be helpful to develop student's understanding and ability to apply the agricultural communication knowledge to be dissemination to the farming community.
Course Description
Meaning, concept, definition scope and type of communication, their process, function role in agricultural development; Element, process and model of communication; Feedback, barriers and theory of communication, its type and approaches; Planning for effective communication; Present trend, issues in agricultural communication; Communication in satellite system, role of governmental and non-governmental agencies in agricultural communication and development.

Course Breakdown (Theory)		
SN	Course Outline	Lectures
1	Communication: Meaning, concept and definition; Importance and scope of communication	1
2	Role / function, process and elements of communication	1
3	Feedback, form and models of communication	1
4	Barriers of communication: Physical, psychological, social and cultural	1
5	Fundamental theories of mass communication: 1) the magic bullet theory, 2) two-step flow theory, 3) multi-step flow theory, 4) uses and gratification theory, and 5) cultivation theory	1
6	Principles of communication	1
7	Effective communication in an organization: Concept, meaning and importance of Organizational Communication	1

8	Concept of ICT and use of ICT in agricultural development	1
9	Communication/ press policies in Nepal	1
10	Meaning, concept, definition, scope and importance of information management	1
11	Communication approaches: Communication considerations involved in developing successful projects/ programs in the world, South-East Asia and SAARC	1
12	Planning for effective communication in agricultural development, trend issue and problem	1
13	New trend and issues in agricultural communication, media - mix	1
14	Satellite system in communication	1
15	Research in communication: Areas, Models and Methods	1
	Total	15
Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	Data representation :Line, Bar, Pie and Pictorial graphs	1
2	Preparation of various kind of charts – Flow, tree, suspense, flip etc.	1
3	Preparation of pamphlet, leaflet and booklet	2
4	Preparation of poster and pictorial book	1
5	Folk song competition among the students	1
6	Preparation and presentation of street drama	1
7	Organization/observation of poster/booklet exhibition	1
8	Communication through bulletin, Flannel and magnetic board.	1
9	Observation and safety use of projector and film/ movie projector	1
10	Study of mobile based application in dissemination of agricultural information	1
11	Visit to local radio station and prepare script for agricultural program	1
12	Communication skill development, presentation skill through MS Power point	1
13	Date collection/ report writing about the effectiveness of local radio/newspaper/ TV in dissemination of agricultural information	1
14	Designing the content suitable to use in Social Media (Facebook, twitter, Instagram, YouTube)	1
	Total	15

Recommended Reading Materials

1. Lionberger, H. F. and Gwin. P. H. (1982). *Communication Strategies – A Guide for Agricultural Change*. University of Missouri, Columbia, US.
2. Dahama, O. P. and Bhatnagar, O.P. (1998). *Education and Communication for Development*. Oxford and IBH Publishing Co. Ltd., New Delhi, India.
3. Oakley, P. and Garforth, C. (1985). *A guide to Extension Training*. University of Reading, UK.

FAR WESTERN UNIVERSITY
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Course Code	AST621
Course Title	Agricultural Statistics and Computer Technology
Credit Hours	3 (2+1)
Full Marks	75
Theory (Marks)	50
Practical (Marks)	25

Objective (s) of the Course
Upon the completion of this course, the students will be able to use different statistical tools used in designing experiments, data analysis and report preparation using advanced computer technologies.
Course Description
An overview of statistics; Sampling methods; Measures of central tendency; Frequency distribution, presentation and summarization of data; Measures of dispersion; Probability and probability distributions; Correlation and regression; Test of significance - Z-test, t-test, X^2 -test; Analysis of variance, one-way and two-way and factorial experiments; Introduction and application of various latest computer technologies.

Course Breakdown (Theory)		
SN	Course Outline	Lectures
1	Introduction	
1.1	Introduction to statistics, definitions, scope and limitations, advanced computer technologies in agricultural statistics	1
2	Population and Sampling	
2.1	Definition of a population; Sample: characteristics of a good sample, sampling methods, simple random sampling	1
2.2	Sample selection from an agricultural field by simple random sampling	1
2.3	Probability proportional to size- stratified random sampling, systematic sampling, cluster sampling, multistage sampling, sampling error	1
3	Measures of Central Tendency	
3.1	Definition of arithmetic mean, median and mode	1
3.2	Merits, demerits and uses of variables of central tendency, properties of an ideal measure of central tendency, partition	1

	values: quartiles, deciles and percentiles	
4	Frequency Distribution	
4.1	Presentation and summarization of data by different classification methods: Exclusive and inclusive; Diagrammatic Bar and Pie charts and graphical methods	1
4.2	Histogram, Frequency polygon, Frequency curve, Ogives (cumulative frequency curves)	1
5	Measures of Dispersion	
5.1	Range, Quartile deviation, Mean Deviation, Standard Deviation and Variance, Coefficient of variation	1
5.2	Moments: raw moments and central moments for grouped and ungrouped data, Relationship between raw moments and central moments	1
5.3	Measures of skewness and kurtosis	1
6	Probability and Probability Distributions	
6.1	Definitions of random experiment, sample space, events: independent and dependent, trial, mutually exclusive events, exhaustive events, equally likely events, simple and compound events	1
6.2	Definitions of probability (classical and statistical), simple problems based on probability, addition and multiplication theorems, conditional probabilities	1
6.3	Probability distributions: Binomial distribution, properties and problems; Poisson distribution, its properties and problems; Normal distribution with its properties and problems; Sampling distributions of mean and differences	1
7	Correlation and Regression	
7.1	Definition, types of correlation, scatter diagram; Karl Pearson's coefficient of correlation (linear correlation), properties, correlation coefficient for bivariate frequency distribution, test for correlation coefficient	1
7.2	Regression (linear), Regression equations of y on x and of x on y, Relation between correlation coefficient and regression coefficients	1
8	Test of Significance	
8.1	Introduction, definition of hypothesis, null and alternative hypotheses, degrees of freedom, levels of significance and types of error	1

8.2	Significance of means: one sample and two sample mean in large samples (Z-test)	1
8.3	Significance of means in small samples (t-test), one sample, two samples and two related samples mean test (paired t-test), F-test, X ² (chi-square) test; Test of independence and goodness of fit	1
9	Principles and Practices of Field-plot Experimentation and Design	
9.1	Replication, Randomization, Local control	1
9.2	One way analysis of variance (Completely Randomized Design)	1
9.3	Two-and three-ways analysis of variance (Randomized Block Design, and Latin Square Design)	1
9.4	Confounding and Factorial experiments (2 ² and 2 ³) with split and strip plot designs	1
10	Computer Technologies in Agriculture Statistics	
10.1	Introduction to IT/ ICT use in agriculture, graphics in computer	1
10.2	Microsoft Excel, statistical programs/packages for social and biological sciences	1
10.3	Using Mobile apps in agriculture for farm advices, market price determination, post-harvest management etc.	1
10.4	Preparation of contingent crop planning and crop calendar using ICT tools	1
10.5	Computer models in agriculture; statistical, weather analysis and crop simulation, IT/ICT application for water and nutrient requirement	1
	Total	30

Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	Central tendency for ungrouped and grouped data (Arithmetic Mean, Median, Mode, Quartiles, Deciles, and Percentiles)	1
2	Classification of data by Exclusive and Inclusive methods; Diagrammatic representation of data by Bar and Pie charts	1
3	Cumulative frequency table from raw data and its graphical representation (Histogram, Frequency Polygon, Frequency curve ogives)	1
4	Measures of dispersion of ungrouped and grouped data (Range, Quartile Deviation, Mean Deviation, Standard Deviation/Variance, Coefficient of variation)	1
5	Moments for grouped and ungrouped data; Measures of skewness	1

	and kurtosis	
6	Simple problems on probability and probability distributions (using the definition of probability- Addition and Multiplication theorems)	1
7	Conditional probability- Binomial, Poisson and Normal distribution	1
8	Computation of correlation coefficient for bivariate frequency distribution and regression equations of y on x and x on y	1
9	Tests of significance of means in large samples (Z-test: one sample and two sample mean test) and in small samples [t-test one sample, two samples and two related samples mean test (paired t test)]	1
10	F-test testing of equality of two population variances	1
11	χ^2 - test: Test of independence and test of goodness of fit	1
12	Analysis of variance - CRD, RCBD, and Latin Square	1
13	Factorial experiment for 2 and 3 factors (Split and strip plot designs)	1
14	Use of Microsoft Excel for calculation of statistical data	1
15	Use of SPSS for the estimation of social science data and MSAT-C/ Mini-Tab/ Gen-Stat/ R-studio for the estimation of ANOVA	1
	Total	15

Recommended Reading Materials

1. Agrawal. B. L. (1996). *Basic Statistics (3rd edition)*. New Age International Pvt. Ltd. New Delhi.
2. Chandel, S. R. S. (1984). *A Hand Book of Agricultural Statistics*. Achal Prakashan Mandir, Kanpur, India.
3. Gupta, S. C. and Kapoor, V. K. (1988). *Fundamentals of Applied Statistics*. Chand and Com. New Delhi.
4. Kalicharan, N. (2001). *An Introduction to Computer Studies*. Cambridge University Press.
5. Singh, S. and Verma, R. P. S. (1982). *Agricultural statistics*. Rama Publishers, Meerut, India.

FAR WESTERN UNIVERSITY
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Course Code	AGR621
Course Title	Advanced Agronomy, Biodiversity Conservation and NUS
Credit Hours	3 (2+1)
Full Marks	75
Theory (Marks)	50
Practical (Marks)	25

Objective (s) of the Course
Upon completion of this course, students will gain knowledge about different concepts of farming system including precision farming, biodiversity conservation, status and importance of neglected and underutilized crop species. Students will be able to identify the major NUS (Neglected and Underutilized Crop Species) crops, constraints in their utilization, understand strategies and develop practical approaches for their promotion along with their agronomy and management practices.
Course Description
Introduction to Nepalese farming system; Rainfed farming; Farming system research and methodology; New approaches of farming: Contract farming, crop diversification, bio-fortification, precision farming, resource conservation technologies (RCT), Biodiversity conservation; Crop simulation modeling; Traditional knowledge and information associated with neglected and underutilized species, its extent and distribution, richness, importance; Crop husbandry of NUS cereals and pseudo cereals, roots and tubers, legumes and vegetables and promoting conservation and use of NUS crop species for healthy food.

Course Breakdown (Theory)		
SN	Course Outline	Lectures
1	Nepalese Farming System and Farming System Research Methodology	
1.1	Introduction to Nepalese farming, their characteristics and major farming systems adopted in irrigated and rainfed farms in Nepal	1
1.2	Farming System Research, their evolution, characteristics and research methodology	1
2	Conventional and Modern Agriculture and Food Security Status in Nepal	

2.1	Scope, practices and economic importance of major food crops in developed and developing world and advances in agriculture and Nepalese food security concerns as defined by SDG goals	1
2.2	Environmental concerns related to intensive use of agricultural inputs and basics on GM crops and transgenic crops in the diversification at global level for improved food and nutritional security	1
3	Precision Farming, Crop Planning and Budgeting	
3.1	Current status and opportunities for adoption of precision agronomy in Nepal, various precision agriculture tools like GIS, GPS, RS, SPAD, NDVI, LCC, SSNM and NOPT, and fertilizer models (Nutrient Expert)	1
3.2	Crop planning and budgeting to increase productivity, profitability and diversification of agri-enterprises	1
4	Protected Agriculture, Contract Farming, and Crop Diversification	
4.1	Concept, characteristics and types of protected agriculture and contract farming, and their scope and limitations in Nepal	1
4.2	Concept, characteristics and types of crop diversification, and scope and limitations of crop diversification in Nepal	1
5	Conservation Agriculture and Resource Conservation Technologies (RCTs)	
5.1	Definition, principles and practices of conservation tillage and conservation agriculture and scope of crop residue management under sole and multiple cropping systems	1
5.2	Resource conservation technologies and modern approaches for improving resource-use efficiency (fertilizer, water, weed and energy) of major crops and cropping systems in Nepal	1
6	Climate Change Adaptation and Mitigation Measures, and Water-use Efficiency	
6.1	Climate change and variability, adaptation and mitigation measures in agronomic crops, agro-climatic indices and their importance in crop production	1
6.2	Water balance in the soil and crop production under nutrient and moisture limitations, ways to increase water use efficiency, stress crop production, crop production by moisture availability and potential evapo-transpiration	1
7	Crop Cut Survey, Yield Forecasting and Crop Simulation Modeling	

7.1	Yield estimation and forecasting tools in agriculture and modern approaches of crop yield forecasting	1
7.2	Crop cut survey and its implications, definition, uses, types, scope and limitation of crop simulation models	1
8	Concept of Biodiversity	
8.1	Definition of biodiversity; Types and importance of biodiversity; Objectives and methods of biodiversity conservation	1
8.2	Biodiversity conservation in Nepal; Works of different organizations working for biodiversity conservation in Nepal and world	1
9	NUS and its Importance	
9.1	Definition and importance of neglected and underutilized crop species (NUS), their distribution and role in food and nutrition security, healthy diet and food systems	1
9.2	Traditional food culture and knowledge systems associated with those crops, current status and future potentiality to promote as new foods	1
10	Introduction, importance and use (managing soil health and nutritional benefit) intercropping, value addition, seed and seed materials, conservation	
10.1	Cereals: Eincorn wheat (<i>Triticum monococcum</i>), Finger millet (<i>Eleusine corocana</i>), Kodo millet (<i>Paspalum scroticulatum</i>), Foxtail millet (<i>Setarica italicum</i>), Porso millet (<i>Panicum miliaceum</i>)	1
10.2	Pseudo-cereals: Amaranth (<i>Amaranthus</i> spp.) and Buckwheat (<i>Fagopyrum esculentum</i>), sorghum	1
10.3	Roots and Tubers: Yams (<i>Dioscorea</i> sp.), Taro (<i>Colocasia esculenta</i>), Parsnip (<i>Pastinaca sativa</i>) and Oca (<i>Oxalis tuberosa</i>)	1
10.4	Fruits and nuts: Monkey orange (<i>Strychnos cocculoides</i>), Key apple (<i>Dovyalis caffra</i>), Tree graped (<i>Lamnea</i> sp)	1
10.5	Fruits and nuts: Star fruit and Strawberry tree (<i>Arbutus unedo</i>) custard apple, jujube fruit, marmelus, rasp berry, Emblika	1
10.6	Legumes: Adzuki bean (<i>Vigna angularis</i>), Rice bean (<i>Vigna umbellata</i>), Lupin (<i>Lupinus mutabilis</i>), Lablab (<i>Lablab purpureus</i>) and Jack bean (<i>Canava liaensiformis</i>), Horse gram, Pigeon pea, Broad bean	1
10.7	Vegetables: Leaf amaranthus (<i>Amaranthus</i> sp.) Locust bean (<i>Parkia bigobosa</i>), Winged bean (<i>Psophocarpus tetragonolobus</i>)	1

10.8	Vegetables: Angle gourd (<i>Luffa aculiangula</i>), Chyote (<i>Sechuim edule</i>) and Jute (<i>Corchous olitorius</i>), Bitter gourd (<i>Momordica charantia</i>), tree tomato	1
11	Good practices for promoting conservation and sustainable use of NUS	1
12	Practical strategies and approaches to promote under-utilized and NUS crops (consumer awareness and linking with crop breeding, product development/diversification, healthy foods, food menu at hotels/ homestays etc.)	1
	Total	30

Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	Collection and identification of seeds of NUS	1
2	Preservation of NUS seeds	1
3	Cultivation, care and maintenance of seasonal NUS plant species	1
4	Field visit to study some of the wild species and their market potentialities	1
5	Identification of plant diseases based on NUS plants	1
6	Identification of insects attacking NUS plants	1
7	Study on soil type and climatic requirements of NUS plant	1
8	Collection of local knowledge about NUS plant and writing report	1
9	Learning visit to nearby communities and organization/ entrepreneurs promoting NUS based foods	1
10	Introduction to farming system research approaches and methodology	1
11	Study on farming system research and extension approaches in Nepal	1
12	Various PRA and RRA tools used in farming system research	1
13	Conceptualization of mother and baby/diamond trials in farming system research	1
14	Group study on various different PRA tools and its presentation by the students' group	1
15	Forcell analysis of seeds for knowing biodiversity in a village	1
	Total	15

Recommended Reading Materials

1. Van Heum, E. and Kees, Van der Post. (2004). *Protected Cultivation: Construction, requirements and use of greenhouse in various climates*. Agromisa Foundation, Wageningen, Netherlands.
2. FAO. (1998). *Farming Systems and Poverty: Improving farmers' livelihoods in a changing world*: www.fao.org/3/a-ac349e.pdf.
3. Govardhan, V. (2000). *Remote Sensing and Water Management in Command Areas: Agro ecological Prospectives*. IBDC.
4. Hunter, D., Borelli, T., and Beltrame, D.M.O. (2019). *The potential of neglected and underutilized species for improving diets and nutrition*. *Planta* 250, 709–729.
5. Jana, B.L. (2008). *Precision Farming*. Agrotech Publishing Academy, Udaipur.
6. Joshi B.K., Shrestha, R., Gautam, I.P., Poudel, A.P. and Gotame, T.P. (2019). *Neglected and Underutilized Species (NUS), and Future Smart Food (FSF) in Nepal*. National Agriculture Genetic Resources Center (NAGRC, National Genebank), NARC, Khumaltar, Kathmandu, Nepal.
7. Joshi, B.K., Shrestha, R., Gauchan, D., and Shrestha, A. (2020). *Neglected, underutilized, and future smart crop species in Nepal*. *Journal of Crop Improvement*, 34:3, 291-313.
8. NAAS. (2009). *State of Indian Agriculture*. National Academy of Agricultural Sciences, New Delhi.
9. Nanduri, K.R. and Mohammad Shahid. (2013). *Neglected and underutilized crops for sustainable agriculture in marginal areas*. Paper presented in 3rd International Conference on Neglected and Underutilized Species: for a Food-Secure Africa.
10. Negi, S.S. (2008). *Biodiversity and its Conservation in India*. Indus Publishing Company.
11. Padulosi, S., Thompson, J., and Rudebjer, P. (2013). *Fighting poverty, hunger and malnutrition with neglected and underutilized species (NUS): Needs, challenges and the way forward*. Biodiversity International, Rome.
12. Palaniappan, S.P. and K. Annadurai. (2006). *Organic Farming - Theory and Practice*. Scientific Publ.
13. Penning de Vries, F.W.T. and Van Laar, H. H. (Eds.). (1982). *Simulation of Plant Growth and Crop Production*. Wageningen Centre for Agricultural Publications and Documentation, Netherlands.
14. Sharma, P. (2007). *Contract Farming*. Daya Publishing House, New Delhi.
15. Will, M. (2008). *Promoting Value Chains of Neglected and Underutilized Species for Pro-Poor Growth and Biodiversity Conservation*. Guidelines and Good Practices. Global Facilitation Unit for Underutilized Species, Rome, Italy.

FAR WESTERN UNIVERSITY
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Course Code	AEN611	
Course Title	Farm Structure and Survey	
Credit Hours	2 (1+1)	
Full Marks	50	
Theory (Marks)	25	
Practical (Marks)	25	
Objective (s) of the Course		
The main objective of this course is to enable the students to (i) prepare and interpret maps/plan, and (ii) learn about farmstead planning, and best estimation and construction practices of farm structure.		
Course Description		
Surveying: definition, classification, units of measurements, scale, chain survey and compass survey; Traversing; Leveling, booking and reducing levels, contour; Construction materials; Components of farm building.		
Course Breakdown (Theory)		
SN	Course Outline	Lectures
1	Introduction: Definition of surveying, classification, units of measurement, scale (graphical and shrunk scale)	1
2	Chain survey: Taping, ranging (direct and indirect), chaining on flat and sloping ground	1
3	Chain triangulation	1
4	Compass survey: Introduction, meridians, bearing, interior angles, types of compass, use of prismatic compass, local attraction	1
5	Traversing and plotting traverse	1
6	Leveling: Objective, instruments, temporary adjustment	1
7	Booking and reducing levels (height of instrument and rise fall method)	1
8	Contour (introduction, characteristics); Topographic map and its uses	1
9	Construction Materials: Bricks, cement, sand, gravel, concrete, mortar, RCC, PCC,	1
10	Materials used in the construction of agricultural structures: Timber, steel, CGI sheet, thatch, centering and shuttering	1
11	Components of farm buildings: Foundation, beam and column	1

	walls	
12	Types of floors, roofs, door and windows	1
13	Site selection and planning of farm buildings, thermal insulation and ventilation process and principle in farm buildings	1
14	Planning, layout and functional requirements of the farm structures	1
15	Estimating and costing: Types and estimate (Approximate and detailed), analysis of rate	1
	Total	15
Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	Linear measurement by Pacing	1
2	Measurement of distance by Ranging and Chaining.	1
3	Chain Triangulation	1
4	Compass traversing	1
5	Profile leveling and grid leveling for contouring	1
6	Determination of elevation of various points by collimation method and rise and fall method	1
7	L-Section and Cross-Section of the Canal	1
8	Determination of area based on field measurement and map measurement	1
9	Contour plotting by square grid method	1
10	Concept of Drawings	1
11	Dairy Cattle House drawing (Plan, elevation and cross-section)	1
12	Poultry House drawing (Plan, elevation and cross-section)	1
13	Swine House drawing (Plan, elevation and cross-section)	1
14	Estimating Quantity of Materials	1
15	Estimating Cost of Construction	1
	Total	15

Recommended Reading Materials

1. Kumar, S. (2010). *Building Construction*. Standard Publishers Distributors, India.
2. DUDBC. (2007). *Nepal National Building Code (NBC 000: 1994) - Reprint 2064*. Department of Urban Development and Building Construction, Ministry of Physical Planning and Works, Government of Nepal.
3. Michael, A. M. and Ojha, T. P. (1978). *Principles of Agricultural Engineering*. Jain Brothers, India.
4. Punmia, B. C., Jain, A. K and Jain A. K (2016). *Surveying (Volume II) - 16th Edition*. Laxmi Publications (P) Ltd., India.

FAR WESTERN UNIVERSITY
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Course Code	ASC621
Course Title	Fundamentals of Dairy Science and Technology
Credit Hours	3 (2+1)
Full Marks	75
Theory (Marks)	50
Practical (Marks)	25

Objective (s) of the Course
Upon the completion of this course, the students will be able to collect samples, test quality, standardize milk and understand the processing of milk.
Course Description
Dairying in Nepal and comparison with developed countries; Definition of milk and diagrammatic representation of milk constituents; Composition and nutritive value of milk; physical and chemical properties of milk, factors affecting the composition of milk, clean milk production; Structure of mammary gland; Biosynthesis of milk and its constituents in brief; Hand milking and machine milking methods; Flavor defects in milk; Types of M.O. found in milk, sources of contamination and significance in dairy industry; Probiotic bacteria and their importance in human health; Definition of dairy technology and some related terminology; Milk purchasing, collection system, preservation and safe transportation to the chilling center, receiving, weighing and sampling of milk; Different platform and routine tests, Straining, filtration, clarification and bacto-fugation of milk; Milk cooling system in Nepal and abroad; Milk homogenization and emulsification; Milk pasteurization, importance and methods; Milk sterilization and ultra-heat treatment and their importance; Milk packaging, storage and distribution systems in Nepal; Process of toning and standardization of market milk; Cleaning, sanitation and maintenance of dairy plant in brief.

Course Breakdown (Theory)		
SN	Course Outline	Lectures
1	Dairying in Nepal, its scope and comparison with developed countries	2
2	Definition of milk and diagrammatic representation of milk constituents	1
3	Composition of milk in brief (fat, lactose, protein, enzymes, vitamins and minerals)	2

4	Nutritive value of milk	1
5	Physical and chemical properties of milk	1
6	Factors affecting the composition of milk	1
7	Clean milk production and factors affecting clean milk production	1
8	Structure of mammary gland, external and internal features of mammary gland	1
9	Biosynthesis of milk and its constituents in brief	1
10	Hand milking and machine milking methods and their importance in dairy farms	1
11	Flavor defects in milk and their causes and prevention measures in brief	1
12	Types of micro-organism (OM) found in milk, their sources of contamination, uses and significance in dairy industry	2
13	Probiotic bacteria and their importance in human health	1
14	Definition of dairy technology and some related terminologies	1
15	Milk purchasing, collection system, preservation and safe transportation to the chilling center	2
16	Receiving, weighing and sampling of milk	1
17	Different platform and routine tests for maintenance of quality of milk	1
18	Straining, filtration, clarification and bacto-fugation of milk	1
19	Milk cooling system in Nepal and abroad	1
20	Milk homogenization and emulsification	1
21	Milk pasteurization, importance and explanation of methods with flow diagram	1
22	Milk sterilization and ultra-heat treatment, their importance and methods of heating	1
23	Milk packaging, storage and distribution systems in Nepal	1
24	Process of toning and standardization of market milk and problems related to it	2
25	Cleaning, sanitation and maintenance of dairy plant in brief	1
	Total	30

Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	Study of commonly used dairy equipment in lab and commonly available dairy products in Nepal	1
2	Study of milk sampling procedures and sediment testing	1
3	Study of COB and ethyl alcohol test (ethanol) for checking suitability of the milk for further processing	1
4	Estimation of SP. Gr. SNF and T.S. in milk by using milk lactometer	1
5	Estimation of fat by Gerber's method	1
6	Study of MBR test for assessing microbiological quality of milk	1
7	Estimation of titrable acidity of milk by titration method	1
8	Estimation of total bacterial counts in milk using SPC method	1
9	Study of cream separator, their parts and assembling, and method of cream separation	1
10	Introduction (definition, nutritive values, uses and flow diagram of method of preparation) and preparation of concentrated dairy products (Ice cream and <i>Khoa</i>)	1
11	Introduction (definition, nutritive values, uses and flow diagram of method of preparation) and preparation of coagulated dairy products (Cheese, Chhena and Paneer)	1
12	Introduction (definition, nutritive values, uses and flow diagram of method of preparation) and preparation of fermented dairy products (Yoghurt and Probiotic milk products)	1
13	Introduction (definition, nutritive values, uses and flow diagram of method of preparation) and preparation of separated dairy products (Butter and Ghee)	1
14	Introduction (definition, nutritive values, uses and flow diagram of method of preparation) and preparation of dry milk product (Powder milk)	1
15	Study of common milk adulterants and their testing for safe milk production	1
	Total	15

Recommended Reading Materials

1. Banerjee, G.C. (2015). *A Text Book of Animal Husbandry (8th Edition)*. Oxford and IBH Publishing. New Delhi.
2. Chandan, R.C. and Arun, K. (2013). *Manufacturing Yoghurt and Fermented Milk (2nd edition)*. Willey-Blackwell Publication, USA.

3. Clarence, H.E., Combs, W. B. and Macy, H. (1994). *Milk and Milk Products*. TATA, McGraw-Hill Publishing Company Ltd, India.
4. Prasad, J. (2016). *Animal Husbandry and Dairy Science (6th Edition)*. Kalyani Publishers, New Delhi India.
5. Sukumar, De. (2000). *Outlines of Dairy Technology*. By Oxford University Press. New Delhi, India.

FAR WESTERN UNIVERSITY
Faculty of Agriculture

Course Code	ENT611
Course Title	Industrial Entomology
Credit Hours	2 (1+1)
Full Marks	50
Theory (Marks)	25
Practical (Marks)	25

Objective (s) of the Course
Upon the completion of this course, the students will be able to understand the clear concepts of beneficial insects such as honey bees, silkworms, lac insects and biological control agents and crop pollinators.
Course Description
Beneficial insects of food, medicine and aesthetic values; Commercialization of honey bees, silkworms, lac insects, bio-control agents; Crop pollinators and eco-environmental indicators.

Course Breakdown (Theory)		
SN	Course Outline	Lectures
1	Introduction of Beekeeping	
1.1	Introduction, history of modern beekeeping, significance, problems and opportunities of beekeeping in Nepal	1
1.2	Major honeybee species in Nepal: exotic and indigenous	1
2	Honeybee castes, Biology and behavior of Honeybees	
2.1	Honeybee castes and biology	1
2.2	Major duties of queen, drone and workers	1
2.2	Honeybee communication, swarming, absconding, rubbing and migration	1
3	Honeybee Management	
3.1	Seasonal colony management for honey production	1
3.2	Artificial queen rearing and queen introduction in the colony	1
4	Honeybee Flora and Pollination	
4.1	Honeybee flora and foraging	1
4.2	Role of honeybees on crop pollination	1
5	Honeybee Problems: Pests, diseases and pesticide poisoning	1
6	Sericulture	

6.1	Definition, history, scope and prospects of sericulture in Nepal	1
6.2	Silkworm rearing technology, harvesting and processing	1
7	Lac culture: Introduction and industrial aspects of Lac insects	1
8	Different aspects of Industrial Entomology	
8.1	Industrial aspects of crop pollinators	1
8.2	Prospects on biological control agents	1
	Total	15

Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	Study of insect products	1
2	Identification of different species of honeybees	1
3	Bee hives and tools used in beekeeping	1
4	Preparation of artificial feeds for different seasons	1
5	Queen preparation technique	1
6	Honey harvesting, processing and storage	1
7	Bee colony transfer and live hive transportation	1
8	Identification of bee flora: nectar, pollen and propolis sources	1
9	Bee keeping records and inventory	1
10	Mites and pests of honeybees	1
11	Silkworm life stages and feeding	1
12	Cleaning and disinfection of silkworm rearing room	1
13	Larval moulting, cocoon harvesting and grading of silkworm	1
14	Humidity, temperature and pest management in silkworm rearing	1
15	Laboratory rearing techniques of bio-control agents: parasitoids	1
	Total	15

Recommended Reading Materials

1. Abrol, D.P. (1997). *Bees and Beekeeping in India*. Kalyani Publishers, New Delhi, India.
2. Ganga, G. and Chetty, J.S. (1991). *An Introduction to Sericulture*. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India.
3. Mishra, R.C. (1998). *Perspectives in Indian apiculture*. Agrobotanica, New Delhi, India.
4. Shukla, A.N. (2000). *Beekeeping Trainer's Resource Book (Nepali)*. ICIMOD, Kathmandu, Nepal.
5. Shukla, G. (2009). *Economic Zoology*. Rastogi Publications, Merrut, Uttar Pradesh, India.

6. SRDP/UNDP (1997). *Mulberry Cultivation and Management Booklet (Nepali)*. SRDP/UNDP. Santibasti, Lalitpur, Nepal.
7. Thapa, R.B. (ed.) (1998). *Sericulture Development Education (Nepali)*. SAN/WDA/WDP, Ilam, Nepal.

FAR WESTERN UNIVERSITY
Faculty of Agriculture

Course Code	AEC621
Course Title	Project Planning and Evaluation
Credit Hours	3 (2+1)
Full Marks	75
Theory (Marks)	50
Practical (Marks)	25

Objective (s) of the Course
To provide basic understanding of PME theory, approaches, methods and practice for effective and responsive programme execution with building on real world challenges.
Course Description
An introduction to Project Cycle Management; Development theories result based management; Project planning: National planning process, planning approaches, programme logic, annual plan implementation arrangement; Monitoring and evaluation: Concept, definition, approaches, national M and E framework, indicators, M and E plan, data collection approach, data collection, report preparation, communication and use of feedback; Evaluation types and approaches, scope of evaluation, evaluation ethics and standard, evaluation criteria, evaluation framework, methods and tools for data collection, evaluation report and use of evaluation.

Course Breakdown (Theory)		
SN	Course Outline	Lectures
1	Development history, theories and practices; Basic understanding of Policy, Program and Project	1
2	Understanding of Planning, Monitoring and Evaluation; Project Cycle Management and Result based management	1
3	Project Cycle Management and Result based management - Real world challenges of project management	1
4	Project/ Program Planning: Theory and importance in development management	1
5	Brief discussion on the Nepalese planning process (Federal, Regional or Provincial and Local or Palika-level)	1
6	Planning approaches: Aligning with the national and local priorities, understanding of socio-economic aspect and financial	1

	analysis	
7	Introduction to program logic and development of program logic (log frame, theory of change) considering risks, driving factors and assumptions	1
8	Preparation of annual action plan with Gantt chart and responsibility	1
9	Implementation strategy/ arrangement: Adaptive management (planning/ managing in difficult situations) and stakeholder engagement	1
10	Process and roles in execution of the interventions and carrying out monitoring and evaluation, communication strategy	1
11	Understanding of monitoring and evaluation (concept, definition, similarity and differences); National Monitoring and Evaluation policies and frameworks	1
12	Monitoring and Evaluation approaches and history	1
13	Role of monitoring (on-going performance assessment and improvement) and potential challenges (data collection, skills of use, data analysis, financial resource, use of feedback)	1
14	Indicators and its types (using SMART approach)	1
15	Development of Monitoring and Evaluation plan (elements – methods)	1
16	Development of Monitoring and Evaluation plan (elements – role, resources and time)	1
17	Data collection approach: Qualitative and quantitative, use of new technology including virtual technology and other tools	1
18	Monitoring data collection (data collection design, data cleaning and analysis)	1
19	Report preparation and communication	1
20	Use of feedback in improvement of project implementation	1
21	Evaluation types: Formative and summative, ex-ante, on-going, ex-post, impact evaluation; Qualitative and quantitative evaluation: external, internal and joint evaluation	1
22	Evaluation approaches: Goal based, goal free, utilization focused, developmental	1
23	Developing scope of evaluation (review of programme logic, assess whether it is appropriate to evaluation, assessment of resources required, developing ToRs)	1
24	Understanding of evaluation ethics (guideline for evaluators – what should (not) be done and standards) – utility, feasibility,	1

	proprietary, accuracy	
25	Understanding of evaluation criteria: OECD DAC criteria for evaluation – relevancy, coherence, effectiveness, efficiency, impact and sustainability	1
26	Developing Evaluation framework: Identifying evaluation questions, selection of indicators	1
27	Developing Evaluation framework: Selection of evaluation methods (virtual or face-to-face survey, FGD, transect walk, KIS)	1
28	Methods/ tools for sampling of projects sites and beneficiaries	1
29	Evaluation data collection; Data type: Qualitative and quantitative; Data analysis- qualitative and quantitative	1
30	Evaluation report sharing with stakeholders and beneficiaries, main elements of an evaluation report; Use of evaluation management response to evaluation	1
	Total	30

Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	Project Planning: Situation and problem analysis	1
2	Project Planning: Development of log-frame, formulation of objectives, outcomes and outputs with key performance indicators	1
3	Project Planning: Development of work plan and Gantt chart	1
4	Project Monitoring: Development of indicators and M and E plan	1
5	Project evaluation: Development of ToRs for evaluation including criteria of a project	1
6	Project evaluation: Development of evaluation framework	1
7	Project Monitoring: Organization visit (to observe their M and E Plan and understanding of challenges)	1
8	Project Monitoring: Preparation of monitoring report	2
9	Project Monitoring: Presentation of monitoring report	1
10	Project evaluation: Project site visit to carry out a rapid evaluation	2
11	Project evaluation: Preparation of evaluation report	2
12	Project evaluation: Presentation of evaluation report	1
	Total	15

Recommended Reading Materials

1. GoN. (2017). *Local Government Operation Act 2074*. Government of Nepal, Kathmandu, Nepal.
2. NPC. (2013). *National Monitoring and Evaluation Guidelines*. National Planning Commission, Government of Nepal, Kathmandu, Nepal.
3. NPC. (2018). *M and E Action Plan 2075/76*. National Planning Commission, Government of Nepal, Kathmandu, Nepal.
4. NPC. (2020). *The Fifteenth Five Year Plan (Fiscal year 2019/20 - 2023/24)*. National Planning Commission, Government of Nepal, Kathmandu, Nepal.

FAR WESTERN UNIVERSITY
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Course Code	HRT611
Course Title	Protected Horticulture
Credit Hours	2 (1+1)
Full Marks	50
Theory (Marks)	25
Practical (Marks)	25

Objective (s) of the Course

Upon the completion of this course, the students will have the skill and recent technical and scientific knowledge to successfully grow the protected crop production system in Nepal.

Course Description

Protected cultivation; Status of protected cultivation; Types of Green Houses; Plant response to Greenhouse environment; Planning and design of greenhouses; Design criteria of green house for cooling and heating purposes; Greenhouse equipment, materials of construction for traditional and low cost greenhouses; Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air greenhouse heating systems; Greenhouse cultivation of important horticultural crops; Cultivation of economically important medicinal and aromatic plants; Off-season production of flowers and vegetables; Insect pest and disease management.

Course Breakdown (Theory)

SN	Course Outline	Lectures
1	Introduction	
1.1	Protected cultivation: importance and scope	1
1.2	Status of protected cultivation in Nepal and world types of protected structure based on site and climate	1
1.3	Types of Green Houses; Plant response to Greenhouse environment	1
1.4	Planning and design of greenhouses; Design criteria of green house for cooling and heating purposes	1
1.5	Green house equipment, materials of construction for traditional and low cost green houses	1
1.6	Irrigation systems used in greenhouses, typical applications, passive solar green house, hot air greenhouse heating systems.	1
2	Greenhouse Cultivation of Important Flower Crops	

2.1	Rose	1
2.2	Gerbera	1
2.3	Carnation	1
2.4	Chrysanthemum	1
3	Greenhouse Cultivation of Important Vegetables	
3.1	Tomato	1
3.2	Cucumber	1
3.3	Strawberry	1
4	Cultivation of economically important medicinal and aromatic plants	
4.1	Aloe, datura and mint	1
4.2	Citronella and lemon grass	1
	Total	15

Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	Study of different type of greenhouses based on shape	2
2	Raising of seedlings and saplings under protected conditions	2
3	Use of portrays in quality planting material production	2
4	Bed preparation and planting of crop for production	2
5	Intercultural operations	3
6	Soil EC and pH measurement	2
7	Determination of drying rate of agricultural products inside greenhouse	1
8	Visit to various post-harvest Laboratories	1
	Total	15

Recommended Reading Materials

1. Hanan, J. J. (1997). *Greenhouses: Advanced Technology for Protected Horticulture*. CRC Press Reference: ISBN 9780849316982.
2. Ernst, V. H. and Van Der Post, K. (2004). *Protected Cultivation: Construction Requirements and Use of Greenhouse in Various Climates*. Agromisa Foundation, Wageningen, Netherlands.
3. Bose, T. K. and Yadav, L. P. (1989). *Commercial Floriculture*. Naya Prakash, Calcutta, India.

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Course Code	PPA601
Course Title	Mushroom Cultivation
Credit Hours	1 (0+1)
Full Marks	25
Theory (Marks)	00
Practical (Marks)	25

Objective (s) of the Course
After the completion of this course, the students will be able to prepare pure culture, spawn production and cultivation of <i>Pleurotus</i> and <i>Agaricus</i> species of mushroom.
Course Description
Importance of mushrooms in human diet; Introduction of commercially cultivated mushroom in Nepal; Identification of edible and poisonous mushrooms, Isolation and maintenance of pure culture, grain spawn production; <i>Pleurotus and Agaricus</i> species: cultivation of <i>Pleurotus</i> and <i>Agaricus</i> species, and milky white mushroom.

Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	General characteristics of edible and poisonous mushrooms	1
2	Collection and preservation of native/wild (edible and poisonous) mushrooms	1
3	Major characteristics of <i>Pleurotus</i> (Oyster mushroom), <i>Volvariella</i> (Paddy straw mushroom)	1
4	Major characteristics of <i>Agaricus</i> (Button mushroom) <i>Lentinula</i> (Shiitake mushroom) and <i>Ganoderma</i> (Red mushroom) species, Milky white Mushroom (<i>Cilocybe indica</i>)	1
5	Potato Dextrose Media preparation and sterilization	1
6	Isolation and preparation of pure culture of <i>Pleurotus</i> spp	1
7	Preparation of grain spawn of <i>Pleurotus</i> spp	1
8	Sterilization of substrates by steaming and Chemical method	1
9	Spawning, bagging and incubation of Oyster mushroom	1
10	Cultivation of Oyster mushroom	1
11	Cultivation of Milky white mushroom	1
12	Harvesting of mushroom	1
13	Identification and management of diseases and insect pests	1

14	Recycling of mushroom compost	1
15	Visit to nearby mushroom farm and report writing	1
	Total	15

Recommended Reading Materials

1. Chandra, R. (2016). *Mushroom Production Technology*. Banaras Hindu University, Department of Mycology and plant pathology, Institute of Agricultural Sciences, Varanasi. Pp.: 1-44.
2. BISWAS, S., Datta, M., and Ngachan, S. V. (2011). *Mushrooms: A Manual for cultivation*. PHI Learning Pvt. Ltd.
3. Khader, V. (1993). *Mushrooms for Livelihood*. Kalyani Publishers, India.
4. Neupane, S. P. (2012). *Nepal ma Chyau Kheti*. Published by: Binita Neupane, Kathmandu, Nepal.
5. Ram, R. C. (2007). *Mushrooms and their Cultivation Techniques*. Aavishkar Publication, Jaipur, India. Pp.: 1-155.

FAR WESTERN UNIVERSITY
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Course Code	AED501 / AED601 / AED701
Course Title	Agri-Enterprise Learning and Development
Credit Hours	0+1
Full Marks	25
Theory (Marks)	00
Practical (Marks)	25

Objective (s) of the Course

Upon completion of this course, students will be able to thoroughly understand the practical aspect of crop and animal husbandry by directly engaging in the commercial production of selected crop and livestock enterprises. This will not only help them learn the biological processes of crop and livestock production, but also help them learn the monetary expenses involved as well as possible profits from these enterprises. This will, ultimately, encourage students for entrepreneurship development by taking up crop/ livestock enterprises after their graduation.

Execution Modality

Each student of 5th, 6th and 7th semester is required to engage in the direct production of selected agronomical crops, horticultural crops and livestock animals (including aquaculture) under the activities of Agri-Enterprise Learning and Development. However, in each semester, a student will be engaged in any one enterprise only and the remaining two enterprises will be taken up in the next semesters. So, in each semester only around one-third of the students are allowed to take up enterprises related to (i) agronomical crops, (ii) horticultural crops or (iii) livestock animals, including fish. Thus, by the end of 7th semester all students shall have been engaged in the production of selected agronomical and horticultural crops as well as selected livestock animals (or fish).

For taking up each of these enterprises, students will be divided into several groups of 5-10 students. Each group of students will be provided a certain amount of revolving fund to take up the enterprise offered by three divisions/units (i) Agronomy, (ii) Horticulture and (iii) Animal Science and Aquaculture. The original amount of funds spent in the project needs to be returned to faculty after completion of the project as a seed money. The enterprise to be taken up will be offered by respective divisions/units. Under the guidance of designated faculty

member, the students will carry out day-to-day activities to successfully grow the selected crops or raise the selected livestock animals/fishes. The students will also record all the financial transactions done throughout this period. The profits from these activities will be equally shared between the students. In case of losses, students should formally write to the designated authority explaining in detail about the reason for losses, approved by the designated faculty member. A team will be prepared to investigate such cases and upon its recommendation such losses could be exempted for paying back.