

FAR WESTERN UNIVERSITY
Faculty of Agriculture
Undergraduate Program in Agriculture
Science



Third Semester Syllabus

B. Sc. Agriculture Science Third Semester Syllabus

S.N.	Name of the Course	Course Code	CH-Th	CH-Pr	CH-Total	Reference Page
1	Agricultural Finance and Cooperation	AEC321	2	1	3	
2	Farm Power and Machinery	AEN311	1	1	2	
3	Field Crop Production - II	AGR321	2	1	3	
4	Fundamentals of Entomology	ENT321	2	1	3	
5	Fundamentals of Ichthyology and Limnology	AQU321	2	1	3	
6	Fundamentals of Microbiology and Biotechnology	MBI321	2	1	3	
7	Fundamentals of Plant Pathology	PPA321	2	1	3	
8	Non-Ruminant Production	ASC311	1	1	2	
9	Vegetable and Spice Crop Production	HRT321	2	1	3	
Total			16	9	25	

FAR WESTERN UNIVERSITY
Faculty of Agriculture

Course Code	AEC321
Course Title	Agriculture Finance and Cooperation
Credit Hours	3 (2+1)
Full Marks	75
Theory (Marks)	50
Practical (Marks)	25

Objective (s) of the Course
Upon completion of this course, the students will be able to understand the issues of agricultural finance, microfinance and agricultural cooperation in rural, urban and international respective.
Course Description
Agriculture finance-meaning, scope and significance; Finance and management functions; Financial principles and decisions; Financial understanding of accounting concepts; Agricultural credit: meaning, need, role, classification and current status; Leveraging finance and partnerships with mainstream financial institutions; Credit demand and supply side situation in Agricultural sector; Credit analysis:4 R's and 3 C's; Introduction to cost of capital, debt, equity and opportunity cost of capital; Service providers in agriculture finance; Recent development in agricultural credit policy; Capital budgeting cum investment decisions; Fiduciary risk in agricultural financing: importance, risk type, risk-utility analysis, management and insurance; Financial statement and cash flow analysis; Introduction to public finance and public debt management; Microfinancing: definition, importance, scope, microfinance standards and principles; Introduction to micro-insurance and microcredit; Agriculture credit flow inclusion; Brief discussion of key institutions implementing microfinance programme; Microfinance model; Cooperatives and cooperation (definitions, principles, history, movement, facts and structure); Cooperative associations: self-help, volunteer and collective benefit; Agriculture cooperatives (types, structure, history, organogram, importance, laws and bylaws for registration, institutionalization and up-scaling); economic and financial viability of agriculture cooperatives; Cooperative marketing status in Nepal, and impact of agricultural cooperatives and cooperation.

Course Breakdown (Theory)		
SN	Course Outline	Lectures

1	Agricultural Finance- meaning, scope and significance	1
2	Finance and management functions	1
3	Financial principles and decisions	1
4	Financial understanding of accounting concepts: Credits, debt, liability, interest, saver, security, borrower, leverage, debit, savings, interest spread, savings, paid-up capital, share capital, bonds, debenture, Ripos , face/par value, redemption value, sinking fund, equity, net-worth, dividend, financial assets, loan amortization, equity capitalization, premium, fiduciary obligations, IBIT, security market and treasure bill	1
5	Agricultural credit: Meaning, need, role, classification and current status in Nepal	1
6	Leveraging finance and partnerships with mainstream financial institutions in Nepal and abroad: Agri, Dev. Bank, Nepal Rastra Bank, Commercial Banks, Development Banks, World Bank, Asian Dev. Bank, IMF, Treasury Bill	1
7	Credit demand and supply side situation in agricultural sector	1
8	Credit analysis:4 R's (repayment, refund, reimbursement, risk bearing) and 3 C's (character, capacity, capital)	1
9	Introduction to cost of capital, debt, equity and opportunity cost of capital	1
10	Service providers in agriculture finance: Non/semi/institutional sources as well as formal and informal source	1
11	Recent development in agricultural credit policy	1
12	Capital budgeting cum investment decisions	1
13	Fiduciary risk in Agricultural financing: Importance, risk type, risk-utility analysis	1
14	Fiduciary risk analysis and management strategies	1
15	Agriculture insurance: Importance, prospect, status and policies	1
16	Financial statement and cash flow analysis	1
17	Introduction to public finance and public debt management	1
18	Microfinancing: Definition, importance, scope, microfinance standards and principles	1
19	Introduction to micro-insurance and microcredit	1
20	Agriculture credit flow inclusion (by gender, ethnicity, geography and province)	1
21	Brief discussion of key institutions implementing microfinance programme (Gramin Bank, Rural Micro-finance Development Center Ltd (RMDC), Centre for micro-finance (CMF), Small	1

	Farmer Development Bank (SFDB)	
22	Microfinance model: Private, Community-derive and Gramin Bank	1
23	Cooperatives and cooperation, definitions, principles, history and movement	1
24	Cooperatives: Facts, structure and figures	
25	The cooperative associations: Self-help, volunteer and collective benefit	1
26	Agriculture cooperatives: Types, structure, history, organogram and importance	1
27	Laws and bylaws of agriculture cooperative for registration, institutionalization and upscaling process	1
28	Economic and financial viability of agriculture cooperatives	1
29	Cooperative marketing status in Nepal	1
30	Impact of agricultural cooperatives: Savings mobilization, credit access, inclusiveness, coverage, competitiveness, financial viability, and self-sustainability	1
	Total	30

Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	Organize excursion of student to commercial banks, MFIs, cooperatives and self-help groups to orient on savings and credit, loan flow, repayments and financial viability	1
2	Prepare balance sheet and analyses net-worth, equity, current capital ratios, working ratio and quick ratio	1
3	Prepare profit and loss account and analyze profitability ratios of viable agri-enterprises	1
4	Prepare cash-flow statement of any agriculture company or cooperatives	1
5	Prepare leverage ratios of viable agri-enterprises	1
6	Estimate inventory and operating ratios of viable agri-enterprise	1
7	Prepare a financial plan and its budgeting of any high value enterprise	1
8	Appraise investment evaluation criteria and acceptance rules for discounting techniques (NPV, IRR, profitability index, payback) and merits and demerits of each technique for above made financing	1

9	Appraise investment evaluation criteria, acceptance rules, merits and demerits of non-discounting techniques (payback, accounting rate of return, return on investment, break-even analysis) of above made financing	1
10	Calculate sensitivity analysis of agricultural financing	1
11	Study on financing and repayment requirements (policy and process) of nearby branch of Agriculture Development Bank	1
12	Study on financing and repayment requirements (policy and process) of nearby branch of any Commercial Bank	1
13	Study on financing and repayment requirements (policy and process) of nearby MFIs/ cooperatives	1
14	Study on financial feasibility and financial viability of nearby agricultural cooperatives or MFIs	1
15	Conduct seminar in value chain financing in agriculture for selected commodity	1
	Total	15

Recommended Reading Materials

1. DoC. (2011). *Cooperative Registration, Operation, Accounting, Monitoring and Regulation Standards, 2068*. Department of Cooperative, MOAC, GOV. (In Nepali)
2. Geman, H. (2015). *Agricultural Finance: From Crops to Land, Water and Infrastructure*. The Wiley Finance Series, John Wiley & Sons Inc.
3. Jha, K. K. (1978). *Agricultural Finance in Nepal: An Analytical Study*. South Asia Books, India.

FAR WESTERN UNIVERSITY
Faculty of Agriculture

Course Code	AEN311
Course Title	Farm Power and Machinery
Credit Hours	2 (1+1)
Full Marks	50
Theory (Marks)	25
Practical (Marks)	25

Objective (s) of the Course

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

- i. Analyze the mechanics involved in farm machines for intended functions, precision in operation, ease of use and control and human drudgery,
- ii. Evaluate and compare the performance of farm machines and equipment's and make selection for different scale of operations, and
- iii. Develop skills on the management, maintenance and upkeep of farm machines and equipment.

Course Description

Source of Farm Power; Objectives and scope of Farm Mechanization; Internal Combustion Engine; Tillage: Primary and secondary tillage implements; Farm machines and equipment, their uses in farm operations, selection and maintenance of farm tools; Seeding and planting machines; Machines and equipment for plant protection; Harvesting and threshing machines; Combined harvesters; Selection and economics of Farm machines and equipment.

Course Breakdown (Theory)

SN	Course Outline	Lectures
1	Sources of farm power, availability, advantages and limitations of different farm power sources; Objectives of farm mechanization; Scope and constraints to farm mechanization in Nepal; Policies and related strategies to farm mechanization in Nepal	1
2	Internal Combustion Engine: Types, components and their functions	1
3	Four stroke and Two stroke Engines- Working principle, advantages and disadvantages	1
4	Definition and objectives of tillage: Primary and secondary tillage; Physical, chemical and biological properties of soil	1

	influenced by tillage; Changing views and practices of tillage	
5	Mould Board Plough and Disc Plough- Types, components and working principle, accessories and attachments	1
6	Harrows: Functions of harrows, types, components and working principle of disk harrows; Selection and uses of harrows	1
7	Rotary Tillage tools and implements: Components and working principle of Rotavator; Advantages and limitations of rotary tillage; Specialized tillage implements and tools- Sub-soiler and chisel plough; Ridger and Bund former, Puddler	1
8	Tools and implements for intercultural operations- Objectives of intercultural operations; Types, construction and working principle of cultivator; Types of intercultural tools: Sweep, shovel, hoe, rotary hoe etc., Horticultural tools	1
9	Methods of seeding and planting: Types, construction and working principle of drills and planters; Seed and fertilizer metering devices; Furrow openers and covering devices in drills and planters	1
10	Rice Transplanters: Types and working principle; Recent advances in seeding and planting machines	1
11	Spraying and dusting: Types of sprayers and dusters; Working principle and components of sprayers; Working principle and components of duster; Safety in handling plant protection machines; Selection and calibration of sprayers and dusters	1
12	Crop harvesting methods; Mowers: Types, working principle, functional parameters of mower cutter-bar; Adjustments and balancing of cutter-bar; Reapers and Wind rowers: Types, working principle; Adjustments and performance; Potato Digger: Working principle; Sugarcane harvester: Working principle; Fruit harvesting machinery	1
13	Threshing methods: Types of threshers, their working principles; Factors affecting thresher performance; Adjustments and trouble shooting in mechanical threshers	1
14	Classification and functional components of grain combines; Material flow and adjustments in grain combines; Adjustments and trouble-shooting in combine harvesters	1
15	Field capacity and efficiency; Selection criteria of Farm Machines and Equipment; Cost of operation of Farm Machines- fixed and variable costs	1
	Total	15

Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	Study on repair and maintenance tools and different machine elements with their functions	1
2	Identification of components of IC engine	1
3	Study of engine system and their care and maintenance - intake and exhaust system, cooling system, lubricating system, fuel supply system, ignition system	2
4	Study of farm tractor control system and their care and maintenance - clutch, gear box, differential, brake, steering, PTO, hitching, hydraulic system	2
5	Operation of tractor and power tiller	1
6	Field performance evaluation of primary tillage implements	1
7	Field performance evaluation of secondary tillage implements	1
8	Calibration and field adjustments in seed drills and planters	1
9	Field performance evaluation of seeding and planting machines	1
10	Field performance evaluation of plant protection equipment	1
11	Field performance evaluation of harvesters	
12	Field performance evaluation of threshers	1
13	Development of farm machinery procurement and management plan for: a) a commercial farm , b) a custom hiring enterprise	1
	Total	15

Recommended Reading Materials

1. Srivastava A.C. (1991). *Elements of Farm Machines, 1st edition*. Oxford and IBH Publishing Co. Ltd., New Delhi, India.
2. Kepner, R.A., Bainer, R. and Barger, E I. (2005). *Principle of Farm Machinery, 3rd edition*. CBS Publishers and Distributors, New Delhi, India.

FAR WESTERN UNIVERSITY
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Course Code	AGR221 / AGR321
Course Title	Field Crop Production - I / II
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 scientific knowledge and skills for growing summer season field crops successfully (This course will be offered either in second or third semester depending on the nature of growing season of the crop).

Course Description

Introduction and importance, origin, area, production, productivity, distribution, soil and climatic requirement, constraints and opportunities of production, improved cultural practices: land preparation, nursery raising, seeds and sowing, nutrients, water and weed management, harvesting, threshing, cleaning, drying and storage, and recommended varieties of rice, maize, millet, cotton, sugarcane soybean, sunflower, groundnut, sesame, black gram, green gram, and pigeon pea.

Course Breakdown (Theory)

SN	Course outline	Lectures
1	Rice cultivation	
1.1	Introduction, importance, origin, area, production, productivity and distribution; Major constraint and opportunity of rice in Nepal	1
1.2	Morphology, growth stages of rice, sub species of sativa: <i>indica</i> , <i>japonica</i> and <i>javanica</i>	1
1.3	Soil and climatic requirements and their effects on rice production; Rice growing seasons in Nepal: Boro, Spring and Rainy season	1
1.4	System of rice culture: Upland (Ghaiya), Transplanted rice (TPR), Dry direct seeded rice (DSR), Wet direct seeded, System of rice intensification (SRI); Recommended rice varieties in Nepal	1
1.5	Methods of raising rice seedlings, land preparation and puddling for seed sowing and transplanting, seed rate, sowing and planting spacing	1
1.6	Nutrient management (green manuring, organic manures, chemical	1

	fertilizer application, bio-fertilizers), irrigation management, weed management, mechanism of nitrogen loss from rice field and their prevention	
1.7	Maturity, harvesting, threshing, cleaning, storage and marketing of rice	1
2	Maize cultivation	
2.1	Introduction, importance, origin, area, production, productivity and distribution, major constraints and opportunities of maize production in Nepal	1
2.2	Soil and climatic requirements, production ecology in Nepal; Recommended or registered maize varieties in Nepal	1
2.3	Cultural Practices: Land preparation, sowing time, seed rate, seed treatments, sowing methods and spacing; importance of winter and spring maize in Nepal	1
2.4	Nutrient management; Water management; Weed management	1
2.5	Maturity, harvesting, threshing, cleaning, drying and storage; Importance of winter and spring maize in Nepal	1
3	Sugarcane cultivation	
3.1	Introduction, importance, origin, area, production, productivity, distribution, major constraints and opportunities of sugarcane production in Nepal	1
3.2	Growth stages of sugarcane, soil and climatic requirement; Characteristics different species of sugarcane	1
3.3	Planting time of sugarcane in Nepal, planting materials, sett selection, preparation and treatments; Planting methods: Flat, Furrow, Ridge and furrow, Trench, Space transplanting (Poly bag seedling transplant) and Ring or Pit method	1
3.4	Fertilizer and manure; Irrigation; Weed management, de-trashing, propping and tying and harvesting	1
3.5	Inter cropping Improved varieties and ratoon management in sugarcane	1
4	Cotton cultivation	
4.1	Introduction, importance, origin, area, production, productivity, distribution, major constraints and opportunities of cotton production in Nepal	1
4.2	Characteristics of cotton species; Soil and climatic requirements; Cotton fiber and its quality; Gossypol	1
4.3	Cultural practices: Seeds and sowing, sowing time, seed rate, spacing, thinning, fertilizer management, weed and irrigation	1

	management, topping, defoliation, desiccation, improved varieties and harvesting	
5	Jute cultivation	
5.1	Origin, history, distribution, production and importance of jute in Nepal; Morphology, growth and development of jute plant	1
5.2	Soil and climate requirement for cultivation; Varieties; Land preparation; Planting spacing; Seed rate; Nutrient management; Irrigation management; Weed management; Quality parameters	1
6	Summer grain legumes (Pigeonpea, Soybean, Blackgram, Greengram and Cowpea) cultivation	
6.1	Origin, history, distribution, production and importance of summer legumes in Nepal	1
6.2	Soil and climate requirement for cultivation of summer legumes	1
6.3	Land preparation; Planting spacing; Seed rate; Nutrient management; Irrigation management; Weed management of summer legumes	1
6.4	Varieties, maturity, harvesting, threshing, cleaning and storage of summer legumes	1
7	Summer oilseed crops (Groundnut, Sesame/ Sunflower) cultivation	
7.1	Origin, history, distribution, production and importance of summer oilseeds in Nepal; Soil and climate requirement for cultivation	1
7.2	Varieties; Land preparation; Planting spacing; Seed rate; Nutrient management; Irrigation management; Weed management; Maturity, harvesting, threshing, cleaning and storage	1
8	Finger millet cultivation	
8.1	Introduction, importance, origin, area, production, productivity and distribution, soil and climatic requirement, major constraints and opportunities of finger millet in Nepal	1
8.2	Cultural practices: Land preparation, seedling raising, sowing/transplanting time, seed rate, sowing methods, relay cropping with maize, fertilizer, weed and water management, recommended varieties, maturity judging, harvesting, threshing, cleaning and storage	1
	Total	30

Course Breakdown (Practical)

S.N	Course outline	Lectures
1.	Study of morphology and growth stages of rice	1

2.	Raising seedling in nursery: Wet bed, dry bed, Dapog and modified Dapog methods with their relative advantage and disadvantage	2
3.	Land preparation and transplanting of rice seedling	1
4.	Nitrogen application in rice through Leaf Color Chart (LCC)/ SPAD meter	1
5.	Study of morphology and growth stages of maize	1
6.	Practice on sowing of summer season crops	1
7.	Practice on weed management of summer season crops	1
8.	Study of morphology and growth stages of sugarcane	1
9.	Numerical problems in relation to seed (sett) requirement of sugarcane in various planting methods	1
10.	Land preparation and planting of cotton	1
11.	Study of morphological characteristics, branching and flowering of cotton	1
12.	Maturity judging and harvesting of summer crops	1
13.	Study of yield attributes and estimation of yield of summer crops	1
14.	Visit to farmers field to study grain-legumes in cropping system	1
15.	Yield and Commercial Cane Sugar (CCS) estimation in sugarcane	1
	Total	15

Recommended Reading Materials

1. Acquaaah, G. (2017). *Principles of Crop Production: Theory, Techniques and Technology*. Pearson Education Inc. India.
2. Jeyaraman, S. (2017). *Crops Production and Management*. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Joshi, B.K., Bhatta, M.R., Ghimire, K.H., Khanal, M., Gurung, S.B., Dhakal, R. and Sthapit, B.R. (2017). *Released and Promising Crop varieties of Mountain Agriculture in Nepal (1959-2016)*. LI-BIRD, Pokhara, NARC, Kathmandu and Biodiversity International, Pokhara, Nepal.
4. Joshi, M. (1990). *Trainer's Manual No.8. Oilseeds*. Publishers: Manpower Development Project, Kathmandu.
5. Prasad, R. (2002). *Text book of Field Crops Production*. ICAR, New Delhi.
6. Rathore, P.S. (1999). *Techniques and Management of Field Crop Production*. Agrosbios, Jodhpur, India.
7. Regmi, K.R. (1990). *Trainer's Manual No.9. Grain Legumes*. Publishers: Manpower Development Project, Kathmandu.
8. Singh C., Singh, P. and Singh, R. (2019). *Modern Techniques of Raising Field Crops*. Revised Edition. Oxford and IBH publishing Co. Pvt. Ltd., New Delhi.

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Course Code	AGR221 / AGR321
Course Title	Field Crop Production - I / II
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 scientific knowledge and skills for growing winter season field crops successfully (This course will be offered either in second or third semester depending on the nature of crops and growing season of the crop).
Course Description
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 wheat, barley, buckwheat, potato, lentil, Chickpea, grass- pea, field bean, rapeseed and mustard, and linseed.

Course Breakdown (Theory)		
SN	Course Outline	Lectures
1	Wheat cultivation	
1.1	Introduction, importance, origin, area, production, productivity, distribution, major constraints and opportunities of wheat production in Nepal	1
1.2	Soil and climatic requirements during different growth stages of wheat	1
1.3	Cultural practices: Land preparation, sowing time, sowing methods, seed rate, seed treatments, spacing	1
1.4	Nutrient management; Weed management; Water management	1
1.5	Recommended varieties, maturity judging, harvesting, threshing, cleaning, drying and storage	1
1.6	Rice-wheat system: coverage, factors affecting R-W system; Major issues of R-W system	1

2	Barley and Uwa cultivation		
2.1	Introduction, importance, origin, area, production, productivity, major constraints and opportunities of barley production in Nepal		1
2.2	Soil and climatic requirements and classification of barley; Cultural practices: land preparation, seed and sowing, sowing times, seed rate, spacing, manure and fertilizer, irrigation, and weed management, recommended varieties, harvesting, threshing cleaning, drying and storage		1
2.3	Introduction, importance, characteristic, nutritional value and distribution of naked barley (Uwa) in Nepal, differences between barley and Uwa		1
3	Buckwheat cultivation		
3.1	Introduction, importance, origin, area, production and productivity, major constraints and opportunities of buckwheat production		1
3.2	Soil and climatic requirements, types of buckwheat; Cultural practices: land preparation, seed and sowing, manures and fertilizer, weed control, water management, recommended and promising varieties, harvesting ,threshing and storage		1
4	Potato cultivation		
4.1	Introduction, importance, origin, area, production, productivity, distribution, major constraints and opportunities of potato production in Nepal		1
4.2	Soil and climatic requirements, and growth stages of potato		1
4.3	Seed and sowing: true potato seed verses potato tuber; Requirements of quality seed, seed preparation and seed treatments, and dormancy		1
4.4	Planting time, methods, seed size and rate, spacing, and fertilizer management		1
4.5	Inter-culture, earthing up, and weeding, irrigation management, recommended varieties, harvesting, grading and storage		1
5	Lentil cultivation		
5.1	Introduction, importance, origin, area, production, productivity, distribution and major constraints and opportunities of lentil production in Nepal		1
5.2	Soil and climatic requirements, classification, growth stages, and its place in cropping system		1
			1
5.3	6	Chickpea cultivation	
	6.1	Introduction, importance, origin, area, production, productivity, distribution and constraints and opportunities of chickpea production in Nepal	

6.2	Soil and climatic requirements, and classification of chickpea; Improved cultural practices: land preparation, manures and fertilizer application, seed and sowing, weed and water management, recommended varieties, harvesting, threshing, cleaning and storage		
7	Grass-pea cultivation		
	Introduction, importance and distribution in Nepal, Anti-nutritional factor and its solution in grass-pea, improved cultural practices of grass pea including relay cropping with rice		
8	Field Beans (<i>Phaseolus spp.</i>) including “RAJMA” cultivation		
8.1	Introduction, importance, origin, distribution and classification of beans (kidney bean, Lima bean, pole bean including Simi, Ghiu Simi, and Jumli Simi)		
8.2	Soil and climatic requirements; Improved cultural practices: land preparation, manures and fertilizer application, seed and sowing, weed and water management, recommended varieties, and harvesting		
9	Rapeseed and mustard cultivation		
9.1	Introduction, importance, origin, area, production, productivity, major constraints and opportunities of rapeseed and mustard in Nepal		
9.2	Soil and climatic requirements, and classification of kinds of rapeseed and mustard grown in Nepal with their characteristics features		
9.3	Improved cultural practices: Place in cropping system, land preparation, seed and sowing: time of sowing, seed rate, and spacing, and manures and fertilizer application		
9.4	Water and weed management, harvesting, threshing, storage and oil quality of rapeseed and mustard		
10	Linseed cultivation		
10.1	Introduction, importance, origin, and distribution in Nepal, soil and climatic requirements and improved cultural practices of linseed production in Nepal		
11	Niger seed cultivation		
11.1	Introduction, importance, origin and distribution in Nepal, soil and climatic requirements and improved cultural practices of Niger production in Nepal		
	Total		

	Improved cultural practices: Manures and fertilizer application, seed and sowing, weed control and water management, recommended varieties, harvesting, threshing, cleaning and storage	
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Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	Planting of winter seasonal crops in agronomy farm of the college	1
2	Classification and study of growth stages of wheat crop	1
3	Classification and morphological characteristics of potato	1
4	Classification and growth stages of a legume	1
5	Sowing and study of different growth stages of lentil, chickpea, rajma and grass pea	1
6	Numerical calculation on seed, fertilizers, pesticides requirements of winter crops like wheat, potato, rapeseed and mustard	1
7	Yield attributes and estimation of yield of winter season field crops	
7.1	Legumes and Oilseed crops	1
7.2	Cereals	1
8	Visit to research station/ agronomy farm to understand different researches	1
9	Fertilizer application (method, time, dose and split) in winter crops	1
10	Rhizobium inoculation in legumes	1
11	Layout and sowing of field crops to conduct field experiment	1
12	Data collection from the agronomic experimentation grown with winter crops	1
13	Visit to nearby farmers to study about grain legumes integration in cropping system	1
14	Calculation of cropping intensity, cropping index and land equivalent ratio	1
	Total	15

Recommended Reading Materials

1. Bhomi, B.K. and Pandey, P. R. (1992). *Trainer's Manual No.18. Potatoes*. Publishers: Manpower Development Agriculture Project.
2. Joshi, B.K., Bhatta, M.R., Ghimire, K.H., Khanal, M., Gurung, S.B., Dhakal, R., and Sthapit, B.R. (2017). *Released and Promising Crop Varieties of Mountain Agriculture in Nepal (1959-2016)*. LI-BIRD, Pokhara, NARC, Kathmandu and Biodiversity International, Pokhara, Nepal.

3. Joshi, M. (1988). *Trainer's Manual Wheat*. Publishers: Manpower Development Agriculture Project, Kathmandu.
4. Joshi, M. (1990). *Trainer's Manual No.8. Oilseeds*. Publishers: Manpower Development Project, Kathmandu.
5. Prasad, R (Editor). (2002). *Text book of Field Crops Production*. ICAR, New Delhi.
6. Rajbhandari, B.P. and Bhatta, G. RD (2008). *Food Crops. Agro- Ecology and Modern Agro- Techniques*. HICAST, Kathmandu, Nepal.
7. Rajbhandari, B.P. and Bhatta, G. D. (2009). *Food Crops. Agro- Ecology and Agro- Techniques of Industrial Crops*. HICAST, Kathmandu, Nepal.
8. Rathore, P.S. (1999). *Techniques and Management of Field Crop Production*. Agrosbios, Jodhpur, India.
9. Regmi, K.R. (1990). *Trainer's Manual No .9. Grain Legumes*. Publishers: Manpower Development Project, Kathmandu.
10. Singh, C. (1997). *Modern Techniques of Raising Field Crops*. Oxford and IBH publishing co. Pvt. Ltd., New Delhi.

FAR WESTERN UNIVERSITY
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Course Code	ENT321
Course Title	Fundamentals of Entomology
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 understand the fundamentals of entomology, and understand the biology of industrially important insects such as honeybee, silkworm and lac insects.
Course Description
Introduction; Benefits and harms of insects; External morphology – cuticle, head, thorax and abdomen; Internal anatomy – different systems; Metamorphosis and development; Classification and study of economically important orders and families of insects; Life cycle of beneficial insects such as honey bee, mulberry silkworm and lac insect.

Course Breakdown (Theory)		
SN	Course Outline	Lectures
1	Introduction	
1.1	Definition and origin, evolution and position of insects in the animal kingdom	1
1.2	Reasons for the dominance of insects over other animals	1
1.3	Beneficial and harmful aspects of insects	1
2	External Morphology	
2.1	Insect body regions- head, thorax and abdomen	1
2.2	Insect cuticle and external processes	1
2.3	Head: segmentation, structure and orientation	1
2.4	Mouth parts and their modifications	1
2.5	Insect antennae and their modifications	1
2.6	Photoreceptors: compound and simple eyes	1
2.7	Thorax: segmentation, structure, legs and their modifications	1
2.8	Wings, venation and their modifications	1
2.9	Abdomen: segmentation, structure and appendages	1
3	Internal Anatomy	

3.1	Digestive system and excretory system	1
3.2	Reproductive system	1
3.3	Circulatory system	1
3.4	Respiratory system	1
3.5	Nervous system	1
4	Insect Metamorphosis, Growth and Development	1
5	System of Insect Classification	1
6	Classification and Study of Economically Important Orders and Families	
6.1	Thysanura, Odonata and Ephemeroptera	1
6.2	Isoptera, Orthoptera and Blattodea	1
6.3	Neuroptera, Siphonaptera and Thysanoptera	1
6.4	Phasmatodea, Psocodea and Embioptera	1
6.5	Mantodea, Dermaptera and Plecoptera	1
6.6	Coleoptera, Lepidoptera and Diptera	1
6.7	Homoptera, Hemiptera and Hymenoptera	1
7	Beneficial Insects	
7.1	Honeybee: beneficial aspects and life cycle	1
7.2	Mulberry silkworm: beneficial aspects and life cycle	1
7.3	Lac insect: beneficial aspects and life cycle	1
8	Sprayers: their parts, calibration and calculation of pesticides	1
	Total	30

Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	Study of a microscope	1
2	Collection and preservation of insects	1
3	External morphology of an insect	1
4	Insect mouth parts and their modifications	1
5	Insect antennae and their modifications	1
6	Insect legs and their modifications	1
7	Insect wings and their modifications	1
8	Insect dissection and study of internal anatomy of an insect (digestive, reproductive, nervous, circulatory and respiratory systems)	1
9	Insect metamorphosis	1
10	Types of larvae and pupae	1
11	Modern beehive and its parts	1
12	Life cycle of honeybee, silkworm and lac insect	1

13	Introduction and principles of insect rearing	1
14	Classification of insects (Important families of the orders: Thysanura, Odonata, Orthoptera, Blattodea, Hemiptera, Homoptera, Coleoptera, Diptera, Lepidoptera, Hymenoptera and other important orders of insects)	1
15	Sprayers and their calibration	1
	Total	15

Recommended Reading Materials

1. Chapman, R. F. (2013). *The insects: Structure and Function*, 5th Ed. Cambridge University Press, Cambridge, United Kingdom.
2. Dhaliwal, G.S. (2015). *Elements of Agricultural Entomology*. Kalyani Publishers, India.
3. Elzinga, R.T. (2003). *Fundamentals of Entomology*. Prentice Hall, New Jersey, USA.
4. Fenemore, P. G. and Prakash, A. (2006). *Applied Entomology*. New Age International, New Delhi.
5. Pedigo, L.P. and Rice, M.E. (2014). *Entomology and Pest Management*, 6th ed. Pearson Prentice Hall, New Jersey, USA.
6. Singh, R. (2016). *Elements of Entomology*. Rastogi Publications, Merrut, New Delhi.

FAR WESTERN UNIVERSITY
Faculty of Agriculture

Course Code	AQU321
Course Title	Fundamentals of Ichthyology and Limnology
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 understand the basic concept of ichthyology and limnology, external morphology of fish, different internal organs, branches of limnology, and aquatic biodiversity of Nepal.
Course Description
Introduction of ichthyology and limnology; Taxonomical classification and characteristics of major fishes of Nepal; Morphology of fish; Different organ systems, structures and functions; Inland water resources in Nepal; Branches of limnology; Aquatic biodiversity; Human impact on lake-ecosystem and Aquatic Animal Protection Act 2017.

Course Breakdown (Theory)		
SN	Course Outline	Lectures
1.	Introduction	
1.1	Brief description of fish, ichthyology, limnology, inland water, and other terminology; General characteristic of fish	1
1.2	Scope and importance of limnology	1
2.	Taxonomical Classification and Characteristics of Major Fishes of Nepal	
2.1	Systematic classification of fish with distinguishing characteristic of each level (up to order)	1
2.2	Brief description of major classes of fish: Elasmobranchii, Holocephali (Chondrichthyes), Dipnoi, Teleostomi (Osteichthyes)	1
2.3	Characteristics of economically important indigenous and exotic species of fish of Nepal	
2.3.1	Chinese carps: Silver carp (<i>Hypophthalmichthys molitrix</i>), Bighead carp (<i>Hypophthalmichthys nobilis</i>) and Grass carp	1

	(<i>Ctenopharyngodon idellus</i>)	
2.3.2	Indian major carps: Catla/Bhakur (<i>Catla catla</i>), Rohu (<i>Labeo rohita</i>) and Naini/ Mrigal (<i>Cirrhinus mrigala</i>)	1
2.3.3	Common carp: <i>Cyprinus carpio var. communis</i> and <i>Cyprinus carpio var. specularis</i> ; Nile tilapia (<i>Oreochromis niloticus</i>); Rainbow trout (<i>Oncorhynchus mykiss</i>)	1
2.3.4	Mangur/Walking catfish (<i>Clarias gariepinus</i>); Pangasius/Baikhi /sutchi catfish (<i>Pangasius hypophthalmus</i>); Silver barb (<i>Puntious gonionotus</i>) Sahar/Golden mahseer/ Pahele sahar (<i>Tor putitora</i>)	1
3.	Morphology of Fish	
3.1	Body division and body shape- Brief description on body division: head, trunk and tail; Brief description of shape and form of fish: Flat or Depressiform, Filliform, Fusiform, Compressiform, Sagittiform Taeniform, Globiform and Anguilliform; Brief description on external organs of fish: mouth (superior, inferior, sub terminal), snout, nostrils, eyes, barbells, operculum lateral line, fins and vent	1
3.2	Fins: Introduction; Types of fins: Paired fins- pelvic fin and pectoral fin: Unpaired fins- anal fin, dorsal fin, adipose fin and caudal fin; Origin of fins: gill arch theory and fin fold theory	1
3.3	Fin rays; Types of caudal fin: Protocercal caudal fin, Heterocercal caudal fin and Homocercal caudal fin; Function of fins	1
3.4	Skin: Introduction; Structure of skin: epidermis layer of skin in fish (mucous gland, poison gland, photophores) and dermis layer of skin in fish; Function of skin	1
3.5	Scales: Introduction; Brief description on different types of scales: Cosmoid scales, Ganoid Scales and Leptoid scales (Cycloid scales and Ctenoid scales); Function of scales	1
3.6	Coloration in fish- Sources of color: Melanophores, Iridophores, Xanthrophores and Erythrophores; Mixed coloration in fish; Color change in fish; Significance of coloration	1
4.	Different Organ Systems: Structure and Functions	
4.1	Digestive system: Food and feeding habits of fish; Relative gut length; Structure and function of alimentary canal: mouth and pharynx, esophagus, stomach, small intestine, large intestine,	1

	cloaca and other associated gland	
4.2	Digestive glands: Liver, pancreas and other glands; Mechanism of digestion: ingestion, digestion, absorption and excretion	1
4.3	Respiratory system	
4.3.1	Respiratory track; Structure of gill: Gill arch, gill raker, gill filaments, pseudobranch and function of gills; Mechanism of respiration	
4.3.2	Accessory respiratory organ in fish- Brief description on different accessory respiratory organ in fish: Buccopharyngeal epithelium, skin, opercular lungs, labyrinthine organs, pharyngeal lungs, air bladder/ swim bladder; Functions of accessory respiratory organ; Significance of accessory respiratory organs	1
4.4	Reproductive system	
4.4.1	Modes of reproduction in fishes: Gonochoristic, Hermaphroditic, Parthenogenetic; Male reproductive organ; Seasonal changes in the testis; Female reproductive organ; Seasonal changes in the ovary	1
4.4.2	Mechanism of gonad development: Spermatogenesis, Oogenesis, Sexual dimorphism; Functions of gonads	1
5.	Inland Water	
5.1	Types of inland waters: Lotic water and lentic water; Origin and classification of water bodies: rivers, lakes, pond, stream, and wetland	1
5.2	Major rivers and freshwater lakes of Nepal: Brief description on major rivers and freshwater lakes of Nepal; Scope of fresh water fisheries in Nepal; Challenges of fresh water fisheries in Nepal	1
6.	Branches of Limnology	
6.1	Physical parameters of limnology- Lake stratification and turn over: Epilimnion, Metalimnion, Hypolimnion, Thermocline; Brief description on different types of lake; Holomictic lake: Oligomictic, Monomictic, Dimictic, Polymictic; Meromictic lake; Amictic lake	1

6.2	Chemical elements and compounds in the lakes and their role in a lake ecosystem; Dissolve oxygen, pH, temperature	1
6.3	Biological limnology- Aquatic ecology and food web: Energy movement in the aquatic ecosystem; Planktons- phytoplanktons and zooplanktons; Food chain and food webs in the lakes: producer, consumers (primary consumer, secondary consumer), and scavengers	1
6.4	Brief description on lake zonation: littoral zone, limnetic zone, profundal zone; Brief description on productivity of lake : Oligotrophic lake, Mesotrophic lake, Eutrophic lake	1
7.	Aquatic Biodiversity	
7.1	Introduction; Brief description on status of aquatic biodiversity of Nepal	1
7.2	Importance of aquatic biodiversity; Threats to Aquatic Biodiversity; Conservation Approaches	1
8.	Human Impact on Lake Ecosystem	
8.1	Source of threats; Method and action for improvement of lake status	1
9.	Aquatic Animal Protection Act, 2017 (1960)	
9.1	Introduction; Objective; Provisions in the law	1
	Total	30

Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	Study of the external morphology of fish	1
2	Study of the internal anatomy of fish	1
3	Sample collection and identification of fish species	2
4	Identification of different types of scales present in teleost	1
5	Identification and study of fish mouth types and their function	1
6	Morphometric measurement of fish	1
7	Study of the accessory respiratory organ of Mangur (<i>Clarius batrachus</i>)	1
8	Study of gills of fish	1
9	Sex determination in fish	1
10	Collection and identification of aquatic plants from different fresh water bodies	2
11	Determination of sexual maturity of brood fish for induced spawning	2
12	Basic diagnosis of diseased fish	1

Total	15
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Recommended Reading Materials

1. Biswas, S.P. (2002). *Fundamentals of Ichthyology*. India: Narendra Publishing House.
2. Gupta, R.K. (2007). *Fundamentals of Ichthyology*. India: Daya Publishing House.
3. Kapoor, B.G., and Khanna, B. (2004). *Ichthyology Handbook*. New Delhi: Narosa Publishing House.
4. Khanna, S.S., and Singh, H. R. (2014). *A Text Book of Fish Biology and Fisheries*. India: Narendra Publishing House.
5. Monson, B. (1992). *A primer on limnology* (2nd ed.). Water Resources Center.
6. Shrestha, T.K. (2008). *Ichthyology of Nepal: A Study of Fishes of the Himalayan Waters*. U.K: Himalayan Ecosphere.
7. Tundisi, J. G., and Tundisi, T. M (2012). *Limnology*. CRC Press.
8. Wetzel, R. G. (2001). Lake and River Ecosystems. *Limnology* (3rd ed., pp. 1006). Academic Press.

FAR WESTERN UNIVERSITY
Faculty of Agriculture

Course Code	MBI321
Course Title	Fundamentals of Microbiology and Biotechnology
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, students will:

Learn the basic concept of agricultural microbiology, useful and harmful microbes in agriculture and role of microorganisms in maintaining crop productivity and soil fertility, and

Understand the basics of biotechnologies, area and scope of biotechnology as well as various techniques that are used in biotechnology.

Course Description

Introduction, scope, importance and practical application of microbiology in agriculture; Comparison between prokaryotic and eukaryotic microorganisms; Role of microorganisms in soil fertility and crop production; Relationships of microorganisms and plants; Biodegradation and bioremediation of agrochemicals; Microbial degradation of organic residues; Plant pathogenic microorganisms; Food microbiology, microorganisms in human welfare; Introduction of biotechnology; Types and techniques of in-vitro cultures; Outlines of basic steps involved in plant biotechnology/ genetic engineering; Gene transfer; Marker assisted selection and its application in plants; DNA finger printing; Mapping quantitative traits locus in agriculture.

Course Breakdown (Theory)

SN	Course Outline	Lectures
1	Introduction to Microbiology and Microorganisms	
1.1	Introduction, historical development, scope and importance of microbiology	1
1.2	Basic characteristics of prokaryotic and eukaryotic microorganisms	1
2	Role of Microorganisms in Soil Fertility and Crop Production	
2.1	Role of microorganisms in formation of soil organic matter, factor influencing the activity of soil microorganisms	1
2.2	Rhizosphere and phyllosphere effects of microorganisms	1

2.3	Different types of plant microbes interaction	1
2.4	Biological nitrogen fixation: types of biological nitrogen fixation	1
2.5	Mechanism of formation of nodules and symbiotic nitrogen fixation by <i>Rhizobium</i>	1
2.6	Basic concept on phospho bacteria and mycorrhizae	1
3	Plant Pathogenic Microorganisms: Signs and symptoms of plant diseases; Disease triangle; Various plant diseases with their causative agents	1
4	Biodegradation	
4.1	Aerobic and anaerobic degradation of carbohydrates, fats and proteins	1
4.2	Concept, principles and processes of bioremediation	1
4.3	Microbial degradation of pesticides and other agrochemicals	1
5	Food Microbiology: Microbial spoilage of foods and toxins produced; Principles of food preservation	1
6	Microorganisms in Human Welfare	
6.1	Importance and mass production of microbial bio-fertilizers; Microbial bio-pesticides, role of microorganisms in compost making	1
6.2	Alcohol fermentation; Effluent management and water purification; Biogas production, antibiotics	1
7	Biotechnology	
7.1	Introduction, definition, scope, importance of biotechnology in agriculture and other disciplines	1
7.2	History of plant tissue culture and genetic engineering; Concept of totipotency	1
8	Types and Techniques of <i>in-vitro</i> Cultures	
8.1	Types of <i>in-vitro</i> cultures in plants	1
8.2	Nutritional requirements of <i>in-vitro</i> cultures	1
8.3	Factors affecting <i>in-vitro</i> cultures; Application and achievements	1
9	Outlines of Basic Steps Involved in Biotechnology / Genetic Engineering	
9.1	Isolation of DNA	1
9.2	Restriction of DNA by endonucleases	1
9.3	Electrophoresis of restricted DNA fragments	1
10	Gene Transfer	
10.1	Vectors for gene transfer	1
10.2	Direct and indirect methods of gene transfer	1
10.3	Application of transgenic plants	1

10.4	Somaclonal and gametoclonal variation in plants	1
11	Marker assisted selection and its application	1
12	DNA finger printing	1
13	Mapping quantitative traits locus in agriculture	1
	Total	30

Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	Elementary knowledge of instruments used and requirement in Plant Biotechnology	1
2	Media preparation for Embryo culture	1
3	Media preparation for Anther culture	1
4	Media preparation for Ovule culture	1
5	Sterilization techniques and inoculation of explants	1
6	Aseptic manipulation of explants	1
7	Callus induction and plant regeneration	1
8	Anther, embryo and endosperm culture	1
9	Demonstration and isolation of nucleic acids	1
10	Isolation of protoplast	1
11	Demonstration and culturing of protoplast	1
12	Demonstration of direct methods of gene transfer techniques	1
13	Demonstration of indirect methods of gene transfer techniques	1
14	Demonstration of gel electrophoresis techniques	1
15	Demonstration of DNA finger printing	1
	Total	15

Recommended Reading Materials

1. Cappuccino, J. G. and Sherman, N. (2010). *Microbiology (A Lab manual) - 7th Ed.* Benjamin Cumming, New York, USA.
2. Pelczar, M. J., Chan, E.C.S, and Kreig, N. R. (1986). *Microbiology*. McGraw-Hill publishers.
3. Bagyaraj, D. J. and Rangaswami, G. (2007). *Agricultural microbiology*. PHI Learning Pvt. Ltd.
4. Saxena, N.P. and Awasthi, D. K. (2003). *Microbiology*. Krishna Prakashan Media Pvt. Ltd. Meerut, India.
5. Singh, R. P. (2012). *Microbiology*. Kalyani Publishers. New Delhi, India.
6. Ignacimuthu, S. (1996). *Basic Biotechnology*. Tata McGraw Hill Publishing Company Ltd., India.
7. Pareek, L. K. and P. L. Swarnkar. (1997). *Trends in Plant Tissue Culture and Biotechnology*. Agro Botanical Publishers, India.

FAR WESTERN UNIVERSITY
Faculty of Agriculture

Course Code	PPA321
Course Title	Fundamentals of Plant Pathology
Credit Hours	3 (2+1)
Full Marks	75
Theory (Marks)	50
Practical (Marks)	25

Objective (s) of the Course
After completion of this course the students will be able to know the importance of microorganisms in agriculture, identify the major plant pathogens their survival, epidemiology, life cycle and general management practices.
Course Description
Introduction of major diseases causing organisms and plant diseases symptoms; General principles of plant pathology including epidemiology; Survival and dissemination; Physiology of infected plants and general management practices.

Course Breakdown (Theory)		
SN	Course Outline	Lectures
1	Introduction, definitions, objectives of Plant Pathology	1
2	History of Plant Pathology with special reference to Nepal	1
3	Classification of plant diseases	1
4	Symptoms and sign of plant diseases	2
5	Definition and characteristics of fungi	1
6	Useful and harmfulness of fungi in human life (Include mushroom shortly)	1
7	Reproduction and fruiting bodies of fungi	1
8	Characteristics of major Fungal genera	4
8.1	Myxomycota: Plasmodiophora, Spongospora and Synchytrium Diplomastigomycotina: Pythium and Phytophthora	1
8.2	Diplomastigomycotina: Albugo, Sclerospora, Plasmopara and Peronospora	1
8.3	Ascomycotina: Taphrina, Protomyces, Erysiphe, Sclerotinia and Claviceps Basidiomycotina: Puccinia, Melampsora, Uromyces, Ustilago,	1

	Tilletia	
8.4	Deuteromycotina: Colletotrichum, Alternaria Cercospora, Fusarium, Helminthosporium, Pyricularia, Sclerotium and Rhizoctonia	1
9	Characteristics of major Bacterial Disease	
9.1	Definition, general morphology of bacterial cell and their function	1 1
9.2	Characteristic of bacteria up to generic level: <i>Xanthomonas</i> , <i>Pseudomonas</i> , <i>Erwinia</i> , <i>Agrobacterium</i> , <i>Streptomyces</i>	
10	Definition, characteristics of virus, examples of plant disease caused by virus	2
11	Transmission of plant viruses	1
12	Mycoplasma, Spiroplasma and Rickettia	1
13	General characteristics of nematode with economically important diseases: <i>Anguina</i> , <i>Globodera</i> , <i>Meloidogyne</i> , <i>Heterodera</i>	1
14	Pathogenicity and Pathogenesis	1
15	Survival of the Pathogens	1
16	Dissemination of Pathogens	1
17	Epidemiology of Plant diseases	1
18	Physiology of Infected plants	1
19	Defense mechanism in plants	
19.1	Pre-exposed defense mechanisms of plants	
19.2	Post exposed defense mechanisms of plants	
20	Principles of Plant disease Management	1
21	Methods of Plant disease Management	2
22	Survey and surveillance of Plant diseases	1
	Total	30

Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	Acquaintance with laboratory equipment	1
2	Study about the microscope	1
3	Study on cleaning and sterilization of glass wares	2
4	Study on PDA medium preparation and its uses	1
5	Field visit to study some of the common diseases	1
6	Identification of plant diseases based on visible pathogens	1
7	Identification of plant diseases based on host pathogen interaction	1

8	Preparation of slide by teasing and identification of lower fungi	1
9	Identification of higher fungi	1
10	Identification of imperfect fungi	1
11	Extraction and identification of pathogenic and saprophyte nematodes	2
12	Calculation of disease incidence and severity	1
13	Calculation of fungicides requirements	1
	Total	15

Recommended Reading Materials

1. Agrios, G. N. (2005). *Plant Pathology. 5th Edition*: Elsevier Academic Press. Burlington, Ma. USA, 79-103.
2. Chaube, H. S. and Singh, R. (2015). *Introductory Plant Pathology*. CBS Publishers and Distributors Pvt. Limited.
3. Pandey, P. (2021). *Laboratory Manual and Workbook on Plant Pathology*.
4. Singh, R. S. (2017). *Introduction to Principles of Plant Pathology*. Oxford and IBH Publishing, New Delhi.

FAR WESTERN UNIVERSITY
Faculty of Agriculture

Course Code	ASC311
Course Title	Non-Ruminant Production
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 identify different breeds, feed, and manage the non- ruminant livestock species.
Course Description
Prominent breeds of pig, care and management and feeding of different age groups of swine; Housing systems, materials used and spacing required, commonly used management practices; Prominent indigenous and commercial breeds of broilers and layers; Rearing and feeding of broilers and layers at different stages of growth; Housing systems, requirements and materials required and design of houses; Egg formation, selection of eggs for incubation; Factors essential for hatching; Brooding methods; Common managerial practices; Vaccination, debeaking, candling, sexing, selection and grading of eggs; Selection and culling of layers; Bio- security in a commercial farm.

Course Breakdown (Theory)		
SN	Course Outline	Lectures
1	Introduction, current statistics, scope and importance of rearing non-ruminants and poultry; Zoological classification of non-ruminants and poultry	1
2	Common breeds of poultry: Rhode Island Red, New Hampshire, Australorp, Sussex, Leghorn, Sakini, Pwankhulte and Ghatikhuile	1
3	Common lines of commercial poultry: Commercial broiler: Cobb-500, Hubbard, Rose, Indian River; Layer: Hyline, Lohnman, H and N nick, Tetra and Giriraj	1
4	Common indigenous breeds of pig: Chwache, Bampudke, Hurra, Pakhribas Black	1
5	Common exotic breeds of pig: Landrace, Duroc, Tamworth, Hampshire, Bampudke and Yorkshire	1

6	Care and management of Horse, Mule and Donkey	1
7	Common care and management of pig (pregnant, lactating, breeding boar and piglet)	1
8	Common care and management of commercial poultry (Layer and Broiler)	1
9	Handling and restraining of Pig, Poultry, Horse, Mule and Donkey	1
10	Housing: Site Selection, types of housing, design of pig housing and barn sanitation	1
11	Housing: Site Selection, types of housing, design of poultry housing and barn sanitation	1
12	Brooding methods of poultry	1
13	Egg formation , selection of eggs for table purpose and incubation	1
14	Selection of egg for incubation and hatching process	1
15	Factors essential for successful hatching/ principle of incubation	1
	Total	15

Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	Study of commonly used equipment in pig and poultry laboratory	1
2	Identification of external body parts of pig and poultry	1
3	Identification of exotic and indigenous breeds of pig	1
4	Identification of common indigenous breeds of poultry	1
5	Identification of common layer and broiler breeds of poultry	1
6	Housing types and model study of pig and poultry with practical references	1
7	Restraining and handling pig and poultry birds	1
8	Debeaking and vaccination of poultry	2
9	Methods of identification of pig (Tagging and Ear notching)	1
10	Castration of pig	1
11	Iron administration to piglets	1
12	Feeding practices of swine	1
13	Feeding practices of poultry	1
14	Study of different types of farm records: Pig and Poultry	1
15	Economics of pig and poultry raising (Case study of pig and poultry farmers)	1
	Total	15

Recommended Reading Materials

1. Banerjee, G.C. (1995). *Poultry (3rd Edition)*. Oxford and IBH Publishing, New Delhi.
2. Banerjee, G.C. (2015). *A Text Book of Animal Husbandry (8th Edition)*. Oxford and IBH Publishing. New Delhi.
3. Banerjee, G.C. (2018). *Principles of Animal Nutrition and Feeds*. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
4. Das, S.K. (2016). *Poultry Production*. CBS Publishers and Distributors Pvt. Ltd. New Delhi India
5. John, R., Campbell, C., Kenealy, M., Dauglas, C. and Karen, L. (2013). *Animal Science (4th Edition)*. Scientific International Pvt. Ltd. New Delhi India.
6. Prasad, J. (2011). *Goat, Sheep and Pig Production and Management*. Kalyani Publishers, New Delhi India.

Sastry, N.R.S. and Thomas, C.K. (2018). *Livestock Production and Management (5th Edition)*. Kalyani Publication, New Delhi India.

FAR WESTERN UNIVERSITY
Faculty of Agriculture

Objective (s) of the Course

Course Code	HRT321
Course Title	Vegetable and Spice Crop Production
Credit Hours	3 (2+1)
Full Marks	75
Theory (Marks)	50
Practical (Marks)	25

This course has been designed for B. Sc. Ag degree students to make them able to know the basic knowledge and skills on the principles and practices of vegetable and spice crop production in Nepal.

Course Description

Present status, importance, prospects and constraints of vegetable and spice crop production in Nepal; Basic principles of vegetable and spice crop production: classification of vegetable and spice crops, climatic and soils factors affecting production and quality, off-season and protected cultivation, riverbed and rainfed farming and nursery management; Description of major vegetable and spice crops on the headings: origin, distribution, area and production in Nepal, climate and soil, important varieties, field preparation, application of manures and fertilizers, intercultural practices, irrigation and drainage, plant protection measures, disorders, off-season and protected production, harvesting and post-harvest handling and brief introduction of minor vegetable crops.

Course breakdown (Theory)		
SN	Course Outline	Lectures
1	Introduction	
1.1	Present status, importance, prospects and constraints of vegetable and spice crops production in Nepal.	1
2	Basic Principles of Vegetable and Spice Crop Production	
2.1	Classification of vegetable and spice crops	1
2.2	Climatic and soils factors affecting vegetable and spice crop production and quality	1
2.3	Off-season and protected cultivation of vegetable and spice crops	1
2.4	Nursery management	1
2.5	Appropriate cultivation practices under river bed and rain-fed condition	1

3	Production Technologies of the major Vegetable and Spice crops which include: Origin, distribution, area and production in Nepal, climate and soil, improved varieties, field preparation, application of manures and fertilizers, intercultural practices, irrigation and drainage, plant protection measures, disorders, off-season and protected production, seed production, harvesting and post harvesting handling	
3.1	Production Technology of Solanaceae Vegetables	
3.1.1	Tomato	1
3.1.2	Potato	1
3.1.3	Brinjal	1
3.1.4	Chilli and sweet pepper	1
3.2	Production Technology of Cruciferae /Brassicaceae Vegetables	
3.2.1	Cauliflower	1
3.2.2	Cabbage	1
3.2.3	Broccoli and Knolkhol	1
3.2.4	Radish and turnip	1
3.2.5	Rayo and Cress	1
3.3	Production Technology of Cucurbitaceae Vegetables	
3.3.1	Cucumber	1
3.3.2	Watermelon, pumpkin and summer squash	1
3.3.3	Bottle gourd and bitter gourd	1
3.3.4	Sponge gourd and pointed gourd	1
3.4	Production Technology of Fabaceae/Leguminosae Vegetables	
3.4.1	Peas, French bean and cow pea	1
3.4.2	Fenugreek	1
3.5	Production Technology of Umbelliferae/Apiaceae Vegetables	
3.5.1	Carrot, coriander and cumin	1
3.6	Production Technology of Zingiberaceae Vegetables	
3.6.1	Ginger and turmeric	1
3.7	Production Technology of Alliaceae vegetables	
3.7.1	Onion and garlic	1
3.8	Production technology of Chenopodiaceae vegetables	
3.8.1	Spinach and swiss chard	1
3.9	Liliaceae and Convolvulaceae vegetables: Asparagus and sweet potato	1
3.10	Malvaceae vegetables: Okra	1
3.11	Brief introduction to the following minor crops	1
3.11.1	Ridge gourd, snake gourd, chayote, muskmelon, broad bean, tree tomato and drumstick	1

3.11.2	Colocasia, Yam, cassava, garden beet, amaranth, Brussel's sprouts, lettuce, celery, parsnip, dill and fennel	1
	Total	30

Course Breakdown (Practical)		
SN	Course Outline	Lectures
1	Identification of seasonal vegetable and spice crop plants and study the morphology of their edible parts	1
2	Identification of vegetable and spice crop seeds and prepare their catalogue	1
3	Layout of kitchen garden and selection of vegetable and spice crops for cultivation	1
4	Nursery bed preparation and sowing seeds of vegetable crops	1
5	Growing seedlings of cucurbitaceous crops under plastic tunnel in winter	1
6	Computation of basal doses of manure and chemical fertilizers and their application	1
7	Calculation of seedlings requirement and their transplanting	1
8	Intercultural practices (earthing up, mulching, irrigation and others)	1
9	Application of side dresses and micronutrients	1
10	Practices of staking, training and pruning	1
11	Preparation and application of pesticides	1
12	PGRs and their application in vegetable crops	1
13	Harvesting and post-harvest handling of vegetable and spice crops	1
14	Display and judging of fresh vegetable crops	1
15	Visit to the commercial vegetable farm near to the FWU campus	1
	Total	15

Recommended Reading Materials

1. ICAR. (2001). *Text Book of Vegetables, Tuber Crops and Spices*. (Ed. S. Thamburaj and Narendra Singh), Indian Council of Agricultural Research, New Delhi, India.
2. Bose, T.K., Som, M. G and Kabir, J. (1993). *Vegetable Crops*. Naya Prakash, Calcutta.

3. Pun, L. and Karmacharya, B.B. (1988). *Trainer's Manual — Vegetables*. Department of Agric, Agric. Manpower Development and Training Program, Kathmandu.
4. Shakya, S.M., Thapa, F. and Pant, J. (1991). *Laboratory Manual on Vegetable Production and Ornamental Horticulture*. IAAS, Rampur, Chitwan.
5. Shanmugavelu, K. G. (1989). *Production Technology of Vegetable Crops*. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Singh, S.P. (1989). *Production Technology of Vegetable crops*. Universal Pub. Centre, Karnal, India.
7. Singh, S.P. (1997). *Principles of Vegetable Production*. Agrotech Pub. Academy, Udaipur.