FAR WESTERN UNIVERSITY
Faculty of Agriculture
Undergraduate Program in Agriculture Science

Fifth Semester Syllabus

B. Sc. Agriculture Science Fifth Semester Syllabus

S.N.	Name of the Course	Course Code	CH-Th	CH-Pr	CH-Total	Reference Page
1	Agricultural Marketing, Trade and Prices	AEC521	2	1	3	
2	Animal Health Management	ASC510	1	0	1	
3	Animal Nutrition and Fodder Production	ASC521	2	1	3	
4	Diseases of Horticultural Crops and their Management	PPA521	2	1	3	
5	Fruit and Plantation Crop Production	HRT521	2	1	3	
6	Insect Pest of Crops and their Management	ENT521	2	1	3	
7	Molecular Approaches in Plant Breeding	PLB521	2	1	3	
8	Principles and Practices of Organic Farming	AGR521	2	1	3	
9	Soil Conservation and Watershed Management	SSC520	2	0	2	
10	Agri-Enterprise Learning and Development	AED501	0	1	1	
Total			**17**	**8**	**25**	

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Course Code	**AEC521**
Course Title	**Agricultural Marketing, Trade and Prices**
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 student will be able to understand basics of marketing, especially with regards to the agricultural products, the theory and principles of agricultural trade, and the trend of agricultural product prices and factors affecting it in order to support them in appropriate decision-making for maximizing farm profits.
Course Description
Introduction to agricultural market and marketing, trade and prices; Nature of agricultural commodities; Classification of markets and marketing; Agricultural product prices; Theory of consumer behavior; Demand and supply functions; Consumers' and producers' surplus; Consumer behavior and supply chain management; Theory of firm; Marketing strategy; Market structure and equilibrium; Markets for agricultural inputs and their price determination; Marketing functions, market structure, market conduct and market performance; Price variation; Value chain development of agricultural products, risk management; Strategic market planning; Marketing research; Marketing efficiency; Regulation of agricultural markets; Public institutions in agricultural marketing.

Course Breakdown (Theory)		
SN	**Course Outline**	**Lectures**
1	Concept, role and importance of food and agricultural markets; rural versus food and agricultural market/ marketing	1
2	Marketing process and the marketing system; direct/ indirect marketing	1
3	Analyzing food and agricultural markets/ marketing	1
4	Nature of agricultural commodities and characteristics of agricultural product and input prices	1

5	Classification and form of agricultural markets based on different dimensions	1
6	Agricultural product prices: farm gate and food market prices	1
7	Theory of consumer behavior: concept of utility and approaches to measure utility, cardinal and ordinal approach; price, income and substitution effect	1
8	Demand function and factors affecting consumer behavior and market equilibrium	1
9	Consumers' and producers' surplus and welfare analysis	1
10	Elasticity: various elasticities of demand, supply	1
11	Relationship among elasticities and application of demand and supply elasticities	
12	Consumer behavior and supply chain management	1
13	Theory of firm, characteristics of firm, supply function and its derivation, life cycle and development of products	1
14	Marketing strategy, market and product promotions	1
15	Market structure and equilibrium: marketable surplus, market structure, market development and competition	1
16	Agricultural input market, cost of production, product quality, price determination and price discrimination	1
17	Marketing functions, physical, exchange and facilitating functions, role of marketing functions	1
18	Marketing channels and their significance	
19	Marketing costs, marketing margins, and price spread	1
20	Price variation, price movement over time, seasonal, annual, trend, irregular and cyclic price variation, spatial price variation	1
21	Spatial distribution of commodities, market boundaries and regional equilibrium models	1
22	Agricultural product processing, value chain development, horizontal integration, and vertical coordination and contracting in agricultural markets	1
23	Market risk assessment and management, strategic marketing plan, market planning tool, and off matrix	1
24	Marketing research: research in agricultural marketing, type and importance of marketing research, technical and economic marketing efficiency and its measurement	1
25	Marketing regulation and government intervention: nature and role of public institutions in product pricing, agricultural marketing, and factors mobility	1

26	Public institutions related to production, marketing and their promotion	1
27	Concept of domestic and international trade, gains and limitations of international trade and theories of international trade	1
28	Balance of trade, terms of trade: concept, types, effect and measurement; balance of payments: trade relation of Nepal with India and China	1
29	Tariff and its effects: optimum tariff, subsidy, quotas, dumping, state trading	1
30	Agricultural trade policy issues raised by WTO, SAPTA, GATT	1
	Total	**30**

Course Breakdown (Practical)		
SN	**Course Outline**	**Lectures**
1	Collection of secondary data on demand, price and supply for a particular commodity, and estimate demand function, supply function and elasticities of demand and supply	1
2	Marketing channels, cost of production, price spread, marketing margin, marketing cost and marketing efficiency	1
3	Analysis of dual role of farmers as producer and retailer	1
4	Marketing middleman, agents and their role in agricultural marketing	1
5	Case studies on cooperative marketing, haat bazaar, collective marketing, wholesale market and retail market	1
6	Value chain analysis of agricultural products	1
7	Risk assessment and management strategies in agricultural marketing	1
8	Opportunities of value chain participation by farmers: problems and prospects	1
9	Cost of marketing, economics of marketing functions and price determination of agricultural products	1
10	Price variation: spatial, premium price and temporal (daily, within day, monthly, seasonal, irregular, cyclical, trend)	1
11	Market information system, use of IT on market information system and its importance	1
12	Strategic marketing plan preparation for selected commodities	1
13	Price determination and marketing efficiency	1
14	Collection of secondary data on export and import of agricultural products and inputs, and relative position and trend of	1

	international trade positions	
15	Balance of trade, terms of trade and balance of payment	1
	Total	**15**

Recommended Reading Materials

1. Crawford, I. M. (1997). *Marketing Research and Information Systems*. Food and Agriculture Organization of the United Nation, Italy.
2. Ferris, J. N. (2005). *Agricultural Prices and Commodity Market Analysis (Second Edition)*. Michigan State University Press, US.
3. Hudson, D. (2006). *Agricultural Markets and Prices (First Edition)*. Wiley-Blackwell, US.
4. Kohls, R. L. and J. N. Uhl. (2015). *Marketing of Agricultural Products (Ninth Edition)*. Pearson India Education Services Pvt. Ltd., India.
5. Koutsoyiannis, A. K. (2008). *Modern Microeconomics (Second Edition)*. MacMillan Press Ltd., India.
6. Norwood, B. and Lusk, J. (2007). *Agricultural Marketing and Price Analysis (First Edition)*. Pearson Education Ltd., UK.
7. Rhodes, V. J., Dauve J. L. and Parcell, J. L. (2006). *The Agricultural Marketing System (Sixth Edition)*. Holcomb Hathaway Publishers, US.
8. Tomek, W. G. and Kaiser, H. M. (2014). *Agricultural Product Prices (Fifth Edition)*. Cornell University Press, US.

FAR WESTERN UNIVERSITY
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Course Code	**ASC510**
Course Title	**Animal Health Management**
Credit Hours	**1 (1+0)**
Full Marks	**25**
Theory (Marks)	**25**
Practical (Marks)	**00**

Objective (s) of the Course
Upon completion of this course, the student will be able to know the common bacterial, fungal, viral and parasitic diseases prevalent in livestock, poultry and pet animals and their management.
Course Description
Terminologies related to animal health and disease; Clinical signs and symptoms of healthy and diseased animals; Approaching Animal: History taking, physical examination; Classification of animal diseases; Transmission of disease of domestic animals; Common bacterial diseases of livestock - HS, BQ, Anthrax, Mastitis, Brucellosis; Common viral diseases of livestock - FMD, PPR; Swine fever; Common bacterial and viral diseases of poultry- Newcastle disease, IBD, Marek's disease, Collibacillosis; Common parasitic diseases of livestock and poultry- Babesiosis, Theleriosis, Trypanosomiasis, Coccidiosis, Liver fluke, Ascariasis, Tapeworm; Metabolic diseases of livestock and poultry: Milk fever, Gout; Reproductive problems in livestock: Anestrous, Dystocia; Vaccination schedule for Cattle, Buffalo, Sheep, Goat, Pig and Poultry.

Course Breakdown (Theory)		
SN	**Course Outline**	**Lectures**
1	Common terminologies related to animal health and diseases	1
2	Clinical signs and symptoms of healthy and diseased animals	1
3	Approaching Animal: History taking, physical examination	1
4	Classification of animal diseases	1
5	Transmission of disease of domestic animals	1
6	Common bacterial diseases of livestock - HS, BQ, Anthrax, Mastitis, Brucellosis	1
7	Common viral diseases of livestock - FMD, PPR, Swine fever	1
8	Common bacterial and viral diseases of poultry- Newcastle	2

	disease, IBD, Marek's disease, Collibacillosis	
9	Common parasitic diseases of livestock and poultry- Babesiosis, Theleriosis, Trypanosomiasis, Coccidiosis, Liver fluke, Ascariasis, Tapeworm	2
10	Metabolic diseases of livestock and poultry: Milk fever, Gout	1
11	Reproductive problems in livestock: Anestrous, Dystocia	1
12	Zoonotic diseases: Rabies-concept and examples	1
13	Vaccination schedule for Cattle, Buffalo, Sheep, Goat, Pig and Poultry	1
14	**Total**	**15**

Recommended Reading Materials

1. Aiello, S.E. (Ed). (2010). *Merc Veterinary Manual (10th Edition).* 2010, Merc and Co. Inc. White House station USA.
2. Blood, D.C. and Rodostitis, G.M. (1989). Veterinary Medicine, A Text book of the Disease of Cattle, Sheep, Pig, Goat and Horse (7th Edition). ELBS Publication
3. Chakravarti, A. (2011). *Text Book of Clinical Veterinary Medicine*. Kalyani Publishers, India
4. Chakravarti, A. (2011). *Text Book of Preventive Veterinary Medicine.* Kalyani Publishers, India
5. ICAR. (2016). *Handbook of Animal Husbandry.* Indian Council of Agriculture Research, New Delhi India.
6. Prasad, J. (2016). *Animal Husbandry and Dairy Science (6th Edition).* Kalyani Publishers, New Delhi India.

FAR WESTERN UNIVERSITY
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Course Code	**ASC521**
Course Title	**Animal Nutrition and Fodder Production**
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 know nutrient requirements, common feed and fodder materials and feeding practices of farm animals.
Course Description
Terminology of animal nutrition; Comparative composition of plants and animal's cells and tissues; Classification, functions and deficiency symptoms of carbohydrates, protein, lipids, minerals and vitamins; Digestion, absorption and metabolism of nutrients in ruminants and non-ruminants; Importance of proximate analysis, feed formulation, feeding standards and nutrient requirements for different farm animals and poultry; Evaluation of nutrient value of feed; Storage, processing and mixing of diet and feed ingredients; Feeding management and nutrient requirement of ruminant and non-ruminant; Terminology of fodder and pasture production in Nepal; Factor affecting nutritive value of fodder and classification of forage and anti-nutritional factors present in forage; Cultivation practices of important legumes and non-legumes including grasses; Alternative feeding resources in use and practice; Hay and silage making and their importance; Silvi-pastoral system and its importance.

Course Breakdown (Theory)		
SN	**Course Outline**	**Lectures**
1	Terminology related to animal nutrition	1
2	Comparative composition of plant and animal cells and tissues	1
3	Classification, function, requirement and food sources of carbohydrate, protein, lipid (fat), macro- and micro- minerals, vitamins and water	2
4	Digestion, absorption and metabolism of food and nutrients in ruminant animals	2

5	Digestion and absorption and metabolism of food and nutrients in non-ruminant animals	2
6	Feed formulation and feeding standard for ruminant (cattle, buffalo, sheep and goat)	2
7	Feed formulation and feeding standard for non-ruminants and poultry (pig and poultry)	2
8	Evaluation of nutrient value of feed; digestibility coefficient and factors affecting digestibility coefficient	2
9	Evaluation of protein value of feed	1
10	Evaluation of energy value of feed; TDN, SE and Partition of energy.	1
11	Storage, processing and mixing of diet and feed ingredients	1
12	Feeding management and nutrient requirement of ruminant	1
13	Feeding management and nutrient requirement of non-ruminant	1
14	Terminology of fodder and pasture production in Nepal	1
15	Factor affecting nutritive value of fodder	1
16	Classification of forage and anti-nutritional factors present in forage	1
17	Cultivation practices of important legumes and non-legumes including grasses; Perennial grasses: oat, jowar, bajra, teosinte, maize, berseem, lucerne and vetch	2
18	Cultivation practices of important legumes and non-legumes including grasses; Perennial grasses: guar, stylo, molasses, setaria, para, rhodes, napier, desmodium and comfrey	2
19	Alternative feeding resources in use and practice	1
20	Hay making and their importance	1
21	Silage making and their importance	1
22	Silvi-pastoral system and its importance	1
	Total	**30**

Course Breakdown (Practical)		
SN	**Course Outline**	**Lectures**
1	Identification of feed ingredients and fodder crops, grasses, legumes and tree fodders	1
2	Proximate analysis of feeds and fodder: DM, moisture and ash	1
3	Proximate analysis of feeds and fodder: CP, EE and CF	2
4	Computation of ration for cattle, buffalo, sheep and goat	1
5	Computation of ration for pig and poultry	1
6	Preparation of urea molasses mineral block and urea treated straw	1

7	Cultivation practices of annual and perennial grasses	2
8	Cultivation practices of annual and perennial legumes	2
9	Hay making	1
10	Silage making	1
11	Preparation of herbarium sheet of common fodder and forages species	1
12	Preparation of seasonal calendar for forage and fodder cultivation	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. Banerjee, G.C. (2018). *Principles of Animal Nutrition and Feeds*. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
3. Benerjee, G.C. (1986). *A Text Book of Animal Nutrition*. Published by Mohan Primlani. Oxford and IBH publishing Co. Pvt. Ltd., Bholanath Nagar, Delhi, India.
4. ICAR. (2016). *Handbook of Animal Husbandry*. Indian Council of Agriculture Research, New Delhi India.
5. Morrision, F. B. (1984). *Feeds and Feeding*. C.B.S. Publishers and distributors. Jam Bhawan.
6. Pande, R S. (1997). *Fodder and Pasture Development in Nepal*. Udaya R D Service (P.) Ltd. Kathmandu Nepal.
7. Pandey, K.K. (1982). *Fodder Tree and Tree Fodder in Nepal*. Swiss Federal Institute of Forestry Research. Birmensdorf, Switzerland.
8. Pathak, N.N. and R C. Jakhmola. (1983). *Forage and Livestock Production*. Bikash publishing house. New Delhi.
9. Prasad, J. (2016). *Animal Husbandry and Dairy Science (6th Edition)*. Kalyani Publishers, New Delhi India.
10. Ranjhan, S.K. (1993). *Animal Nutrition in the Tropics*. Vikash publishing house Pvt. Ltd India.
11. Ranjhan, S.K. (1993). *Animal Nutrition and Feeding Practices in India*. Vikash Publishing House Pvt. Ltd India.
12. 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

Course Code	**PPA521**
Course Title	**Diseases of Horticultural Crops and their Management**
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 identify the major diseases of horticultural crops, their etiology, epidemiology, disease cycle and their management.
Course Description
Major diseases of summer vegetables, winter vegetables, temperate fruits, subtropical and tropical fruits, some spice crops with special reference to Nepal; their symptoms, etiology, epidemiology, disease cycle and management practices.

Course Breakdown (Theory)		
SN	**Course Outline**	**Lectures**
1	Late blight of potato and tomato	1
2	Early blight of potato and tomato, Septoria leaf spot of tomato	1
3	Potato wart and black scurf of potato	1
4	Damping off of vegetable seedlings and diseases of cut flowers	1
5	Sclerotinia blight of vegetables	1
6	Alternaria leaf spot of Cole crops, radish and broad leaf mustard	1
7	Club root of crucifers	1
8	Powdery mildew of pea, Rust of bean, Powdery and downy mildews of cucurbits	1
9.	Bean Anthracnose and White mold of French bean	1
10	Gummy Stem blight of cucurbit, Phomopsis blight of brinjal	1
11	Phytophthora blight of chilli, Cercospora leaf spot of chilli	1
12	Fruit Rot/ Die back of chilli	1
13	Stem gall of coriander, purple blotch of onion	1
14	Rhizome rot of ginger, Leaf blight of turmeric	1
15	Mango Malformation	1
16	Mango Anthracnose	1

17	Powdery mildew and downy mildew of grape	1
18	Peach leaf curl, Red rust of litchi	1
19	Panama wilt and Sigatoka leaf spot of banana	1
20	Apple scab, Papery bark of Apple	1
21	Papaya damping off, Ring spot disease of papaya	1
22	Guava wilt, Guava canker	1
23	Bacterial wilt of potato	1
24	Citrus canker and Citrus decline	1
25	Cucumber mosaic, Cowpea mosaic and Bean mosaic	1
26	Viral diseases of potato and tomato	1
27	Root knot nematode of vegetables	1
28	Rhizome rot and Chirkey and Foorkey disease of cardamom	1
29	Stem rot and Powdery mildew of rubber	1
30	Blister blight of tea and rubber and Red rust of tea	1
	Total	**30**
Course Breakdown (Practical)		
SN	**Course Outline**	**Lectures**
1	Field visit to identify the causative organisms of the diseases around the vicinity of college	1
2	Dry and wet preservation of collected sample of vegetable and fruit diseases	1
3	Preparation of PDA and other growth media	1
4	Isolation and multiplication of pathogen in growth media	1
5	Growing on test for fungal, viral and bacterial seed transmission	1
6	Isolation of bacteria from ooze test/infected sample	1
7	Isolation of nematode from infected sample	1
8	Preparation of bacterial growth media	1
9.	Transverse section cutting to study of host parasite interaction (fruit crop)	1
10	Transverse section cutting to study of host parasite interaction (vegetable crop)	1
11	Study disease incidence and intensity from the group work trail	1
12	Staining and identification of gram positive and gram negative bacteria	1
13	Study about market available botanical, biological and chemical fungicides	1
14	Study of seed borne pathogens from platting method	1
15	Seed treatment and foliar spray	1
	Total	**15**

Recommended Reading Materials

1. Agrios, G. N. (2005). *Plant Pathology 5th Edition*: Elsevier Academic Press. Burlington, Ma. USA, 79-103.
2. Pandey, P. (2021). *Laboratory Manual and Workbook on Plant Pathology*, 1st Ed.
3. R S Mehrotra. and Aggarwal, A (2017). *Plant Pathology.* McGraw Hill Education (India) Private Limited.
4. R.S. Singh (2005). *Plant Disease (8th edition).* Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
5. Verma, L. R., and Sharma, R. C. (1999). *Diseases of Horticultural Crops: Vegetables, Ornamentals, and Mushrooms*. Indus Publishing.
6. Verma, L. R., and Sharma, R. C. (1999). *Diseases of Horticultural Crops: Fruits*. Indus Publishing.

FAR WESTERN UNIVERSITY
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Course Code	**HRT521**
Course Title	**Fruit and Plantation Crop Production**
Credit Hours	**3 (2+1)**
Full Marks	**75**
Theory (Marks)	**50**
Practical (Marks)	**25**

Objective (s) of the Course
The students will get knowledge regarding the potential fruit and plantation crop growing areas in Nepal for commercial production and will understand and gain skills about the physiology, growth behavior, nutrient, cultural requirements and management of important fruit and plantation crops.
Course Description
Scope and importance of fruit and plantation crop production in Nepal; Classification of fruits based on climate requirement, pomological classification and growth habit etc; Identification of potential pocket area for commercial production of fruit and plantation crops; Origin, botany, uses, distribution/ area/ production, climate, soil, cultivar, planting, propagation, training and pruning, growth behavior, flowering, fruit set, fruit drop, nutrition, manure and fertilizers, irrigation, intercropping, use of bio-regulators, disease and pest, specific problem, physiological problems, harvesting, storage and marketing of banana, mango, papaya, pineapple, jackfruit, litchi, guava, citrus, pomegranate, apple, pear, peach, plum, walnut, apricot, kiwi, strawberry, grape, tea, coffee, cardamom and other indigenous and under-exploited fruit crops.

Course Breakdown (Theory)		
SN	**Course Outline**	**Lectures**
1	**Introduction**	
1.1	Scope, importance and constraints of fruits and plantation crops in Nepal	1
1.2	History and government policy of fruit and plantation sector development in Nepal	1
1.3	Major potential pocket areas for commercial production of fruit and plantation crops	1
2	**Cultivation Practices of Tropical and Sub-tropical Fruits:** Introduction, 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 propagation, plant protection measures, disorders, off-season and protected production, seed production, harvesting and post harvesting handling	
2.1	Banana	2
2.2	Mango	2
2.3	Papaya	1
2.4	Pineapple	1
2.5	Jack fruit	1
2.6	Litchi	1
2.7	Guava	1
2.8	Citrus	2
3	**Cultivation Practices of Temperate Fruits:** Introduction, 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 propagation, Plant protection measures, disorders, off-season and protected production, seed production, harvesting and post harvesting handling	
3.1	Apple	1
3.2	Pear	1
3.3	Peach	1
3.4	Pulms and nectarines	1
3.5	Walnut	1
3.6	Kiwi	1
3.7	Grapes	1
4	**Cultivation Practices of Indigenous and Under-exploited Crops**	
4.1	Aonla, Persimmon and Macademia	1
4.2	Custard apple, wood apple and bael	1
4.3	Avocado and apricot	1
4.4	Ber, lapsi and passion fruit	1
4.5	Dragon fruit and olive	1
5	**Cultivation practices of tea**	1
6	**Cultivation practices coffee**	2
7	**Cultivation practices cardamom**	1
	Total	**30**

Course Breakdown (Practical)		
SN	**Course Outline**	**Lectures**
1	Identification of tools, equipment and chemicals used in the production of fruit and plantation crops	1
2	Field visit, identification of species and varieties of fruit and plantation crops	1
3	Layout and planning of orchard	1
4	Digging and filling back of pits	1
5	Practices of cutting and layering	1
6	Practices of grafting and budding	1
7	Processing of coffee / tea/ cardamom	1
8	Detachment of layered/ grafted plant, preparation of seedling/sapling and transplanting	1
9	Training of fruit and plantation crops	1
10	Pruning of fruit and plantation crops	1
11	Fertilizer application and irrigation practices	1
12	Calculation, preparation and application of stock solution of plant growth regulators and micronutrients	1
13	Sampling technique for soil and plant parts for nutrient analysis	1
14	Visit to tropical/subtropical/temperate horticultural farm	1
15	Preparation of project for establishing enterprises on fruit /plantation crop/orchard	1
	Total	**15**

Recommended Reading Materials

1. Chattopadhay, T.K. (2001). *A Text Book on Pomology. Vol I, II, III and IV*. Kalyani Publishers, India.
2. Kumar, N., Abdul, K., Rangaswami, P. and Irulappan, I. (2000). *Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants*. Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi, India.
3. Ponnuswami, V., Kumar, M., Ramesh Kumar, S. and Krishnamoorthy, C. (2015). *Text Book on Fruit and Plantation Crops*. Narendra Publishing House.
4. Shrestha, G. K. (2016). *Fruits and Plantation Crops: Basic Principles, Production Techniques and Practical Skills*. Heritage Publishers and Distributors Pvt. Ltd., Nepal.

FAR WESTERN UNIVERSITY
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Course Code	**ENT521**
Course Title	**Insect Pests of Crops and their Management**
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 know common insect pests of crops, their identification and management practices using bio-rational techniques.
Course Description
Systematic position, distribution, host identification, nature and extent of damage, life cycle, seasonal histories and control measures of important insect and non-insect pests of cereals and millets, pulses, oilseeds, vegetables, fruits, industrial crops, spices and condiments grown in Nepal; Important stored grain pests and their control; introduction and management of medical and veterinary, vector borne, polyphagous and soil hibernating insect pests.

Course Breakdown (Theory)		
SN	**Course Outline**	**Lectures**
1	**Insect Pests of Cereal crops and their Management**	
1.1	Insect pests of rice and their management (Yellow stem borer, brown plant hopper, rice grasshopper, seed bed beetle, rice ear-head bug, rice ear-cutting caterpillar, rice hispa, case worm, leaf folder and others)	1
1.2	Insect pests of maize and their management (Maize stem borer, fall armyworm, white grub, wireworm, flower beetle and others)	1
1.3	Insect pests of wheat and millet and their management (Pink borer, armyworm, grasshopper, cutworm, termite, aphid and others)	1
2	**Insect Pests of Pulse crops and their Management**	
2.1	Insect pests of chickpea, beans, blackgram and green gram (Chickpea pod borer, pod fly, soybean hairy caterpillar, pea leaf miner, pea pod borer, sphinx moth, semilooper, legume pod bug	1

	and others)	
2.2	Insect pests of lentil, pigeon pea and mung bean (Spotted pod borer, plume moth, pod weevil, blister beetle, whitefly, stem fly and others)	1
3	**Insect Pests of Oilseed crops and their Management**	
3.1	Insect pests of mustard, rapeseed, sesame and sunflower (Mustard aphid, painted bug, mustard sawfly, white grub and others)	1
3.2	Insect pests of groundnut and soybean (White grub, groundnut aphid, groundnut leaf miner, soybean hairy caterpillar, soybean pod borer and others)	1
4	**Insect Pests of Vegetables and their Management**	
4.1	Insect pests of crucifer crops (Cauliflower, cabbage and broccoli) (cabbage butterfly, diamond back moth, flea beetle, mustard sawfly, cabbage aphid, cutworms and others)	1
4.2	Insect pests of solanaceous crops (Potato, tomato, chilli and brinjal) (Tomato fruit borer, tomato leaf miner, whitefly, brinjal shoot and fruit borer, red ant, potato tuber moth, chilli thrips, brinjal leaf roller and others)	1
4.3	Insect pests of cucurbits (Cucumber, pumpkin, bitter gourd, bottle gourd, sponge gourd, pointed gourd, summer squash, chayote and melons) (Red pumpkin beetle, cucurbit stink bug, spotted beetle, pumpkin fruit fly, banded blister beetle and others)	1
4.4	Insect pests of okra, onion and garlic (Okra shoot and fruit borer, leaf hopper, onion thrips, whitefly, onion maggot and others)	1
5	**Insect Pests of Fruits**	
5.1	Insect pests of mango (Mango hopper, mango mealybug, mango stem borer, mango shoot gall maker, mango stone weevil, mango fruit fly)	1
5.2	Insect pests of citrus (Citrus stink bug, lemon butterfly, citrus red scale, citrus leaf miner, citrus psylla, brown citrus aphid, orange stem borer, citrus fruit fly and others)	1
5.3	Insect pests of banana (Banana rhizome weevil, banana skipper, banana pseudostem weevil, banana leaf and fruit scarring beetle, banana aphid and others)	1
5.4	Insect pests of litchi (Litchi bug, litchi leaf curl mite, red ant, bark eating caterpillar and others)	1

5.5	Insect pests of pomegranate, dragon fruit and kiwi (Pomegranate butterfly, bark eating caterpillar, scale, thrips, mealybug, aphid, and others)	1
5.6	Insect pests of apple and other temperate fruits (Wooly apple aphid, San Jose Scale, peach leaf curl aphid, codling moth, borer, tent caterpillar and others)	1
6	**Insect Pests of Industrial crops and their Management**	
6.1	Insect pests of sugarcane (Sugarcane top borer, early shoot borer, root borer, whitefly and others)	1
6.2	Insect pests of jute (Jute mealybug, jute semilooper, jute stem weevil, jute hairy caterpillar and others)	1
6.3	Insect pests of cotton (Pink bollworm, cotton jassid, whitefly, American bollworm, cotton stem weevil, red cotton bug and others)	1
7	**Insect Pests of Plantation crops, spices and condiments and their Management**	
7.1	Insect pests of tea and coffee (Coffee white stem borer, coffee berry borer, leaf hopper, whitefly, tea mosquito bug, tea weevil, tea mites and others)	1
7.2	Insect pests of ginger, turmeric and cardamom (Shoot borer, leaf roller, rhizome scale, white grub, leaf beetle and others)	1
8	**Insect Pests of Ornamental crops**: rose, marigold, gladiolus, carnation and chrysanthemum (Aphid, leafhopper, whitefly, scale insects, thrips, leaf hopper, and others)	1
9	**Insect Pests of Storage products and their Management**	
9.1	Factors governing stored grain losses	1
9.2	Storage insect pests of cereals, pulses, oilseeds, flour, tubers and others (Rice weevil, maize weevil, granary weevil, rice moth, Angoumois grain moth, cowpea weevil, pulse beetle and others)	1
10	**Major Vector Insects, rodents and their Management**	
10.1	Insect vectors of plant and animal diseases and their management	1
10.2	Rodent and vertebrate pests and their management	1
11	**Medical, Veterinary and Household insect pests**	
11.1	Mosquitoes, louse, fleas, flies and cockroach	1
11.2	Ticks, mites and parasites	1
12	**Pest Resistance, pesticide residues and health problems**	1
	Total	**30**

Course Breakdown (Practical)

SN	Course Outline	Lectures
1	Periodic visits to farms for crop pests monitoring	1
2	Farm visit for collection and identification of predators and parasitoids	1
3	Farm visit for collection and identification of pollinators	1
4	Collection and identification of major insect pests of rice/ wheat	1
5	Collection and identification of major insect pests of maize/ millets	1
6	Collection and identification of major insect pests of pulse crops	1
7	Collection and identification of major insect pests of oilseed crops	1
8	Collection and identification of major insect pests of crucifer crops	1
9	Collection and identification of major insect pests of cucurbit crops	1
10	Collection and identification of major insect pests of solanaceous vegetables	1
11	Collection and identification of major insect pests of industrial crops	1
12	Collection and identification of major insect pests of tropical fruit crops	1
13	Collection and identification of major insect pests of sub-tropical/temperate fruit crops	1
14	Collection and identification of major insects pests of stored grains	1
15	Identification and management of rodents	1
	Total	**15**

Recommended Reading Materials

1. Atwal, A.S. and Dhaliwal, G.S. (2015). *Agricultural Pests of South Asia and their Management*. Kalyani Publishers, New Delhi, India.
2. Neupane, F.P. (2000). *Bali Biruwa Ka Satruharu Ra Tinka Roktham (Nepali).* 4th ed. Sajha Prakashan, Kathmandu, Nepal.
3. Paneru, R.B. and Giri, Y.P. (2011). *Management of Economically Important Agricultural and HouseholdPpests of Nepal*. NARC, Entomology Division, Khumaltar, Lalitpur, Nepal.
4. Panwar, V.P.S. (2017). *Agricultural Insect Pests of Crops and their Control. 3rd ed*. Kalyani Publishers, New Delhi, India.

5. Srivastava, K.P. and Butani, D.K. (2009). *Pest Management in Vegetables*. Stadium Press, New Delhi, India.
6. Tiwari, S. and Thapa, R. B. (2012). *Laboratory Manual of Economic Entomology*. Tribhubhan University, IAAS, Department of Entomology.

FAR WESTERN UNIVERSITY
Faculty of Agriculture

Course Code	**PLB521**
Course Title	**Molecular Approaches in Plant Breeding**
Credit Hours	**3 (2+1)**
Full Marks	**75**
Theory (Marks)	**50**
Practical (Marks)	**25**

Objective (s) of the Course
Students pursuing this course will acquire theoretical knowledge and practical skills on plant biotechnology, different molecular tools and approaches used in plant breeding for crop improvement.
Course Description
Nature of gene; Application of biotechnology in plant breeding, Restriction enzymes, vectors, electrophoresis, PCR, Blotting techniques, rDNA technology; Transformation methods, transgenes, markers, tissue culture, marker assisted selection; QTLs, mapping population, GMO issues; Biosafety measures and intellectual property rights in plant breeding.

Course Breakdown (Theory)		
SN	**Course Outline**	**Lectures**
1	Historical background of molecular genetics, genetic material in organisms	1
2	Central dogma of molecular biology and its applications in plant breeding	1
3	Classical and modern concept of gene, fine structure of gene, gene theories	1
4	Gene expression and regulation of gene expression in eukaryotes (Britten and Davidson model), genetic code properties	1
5	Biotechnology definitions and history, biotechnology in Nepal	1
6	Plant biotechnology, applications, achievements, future aspects and relationship with other sciences	1
7	Nucleic acid isolation and storage	1
8	Polymerase chain reaction, gel electrophoresis and SDS page	1
9	Reverse transcription and cDNA synthesis	1
10	Quantitative and qualitative estimation of DNA, RNA and protein in an organism	1

11	Blotting techniques for DNA and RNA	1
12	Gene cloning, restriction enzymes and their types	1
13	Gene cloning vectors and their types: Plasmid, Phage, Phasemid, Cosmids, BACs, YACs	1
14	Recombinant DNA technology and methods of gene transfer	1
15	*Agrobacterium* mediated gene transfer, traitor genes and terminator genes	1
16	Morphological, biochemical and genetic markers in plant breeding	1
17	Molecular markers and its types (PCR and non-PCR based markers)	1
18	Marker assisted selection for qualitative and quantitative traits, gene pyramiding	1
19	Statistical tools in marker analysis, application of molecular markers in crop improvement	1
20	Marker-assisted backcross breeding for rapid introgression of traits	1
21	Mapping populations (F2s, back crosses, NILs, RILs and double haploids)	1
22	Quantitative trait loci (QTL), genome wide association mapping	1
23	Introduction to omics approaches (genomics, proteomics, metabolomics, ionomics etc.) in molecular plant breeding	1
24	Bio-informatic tools and its use for molecular plant breeding	1
25	Biotechnology applications in hybrid breeding	1
26	Transgenes, transgenic approaches in crop improvement	1
27	Plant cell and tissue culture, principle and types (callus, cell suspension, anther culture, ovule culture, meristem culture and embryo culture)	1
28	Haploid and triploid production, somatic hybridization, cybridization	1
29	Somaclonal and gametoclonal variation, wide hybridization *in vitro*	1
30	GMOs and related issues (risk and regulations); International regulations and biosafety issues, intellectual property right	1
	Total	**30**

Course Breakdown (Practical)		
SN	**Course Outline**	**Lectures**
1	Laboratory handling and safety measures	1

2	Organization of tissue culture laboratory	1
3	Identification of tools of tissue culture laboratory	1
4	Elementary chemical calculations	1
5	Preparation of buffers and reagents	1
6	Tissue culture media preparation	1
7	Tissue culture propagation	1
8	Plant genomic DNA isolation	1
9	Quantification of DNA and agarose gel electrophoresis	1
10	Demonstration of PCR	1
11	RNA isolation	1
12	Sterilization techniques used in plant tissue culture	1
13	Somaclonal variations in tissue culture	1
14	Hardening and field evaluation of tissue culture products	1
15	Accessing and storing genetic databases	1
	Total	**15**

Recommended Reading Materials

1. Abdin, M. Z., Kiran, U. and Ali, A. (Eds.). (2017). *Plant Biotechnology: Principles and Applications*. Springer Singapore.
2. Chopra, V. L. and Nasim, A. (1990). *Genetic Engineering and Biotechnology; Concepts, Methods and Applications* (No. 660.65 G328). Oxford and IBH Publishing.
3. Howe, C. (2007). *Gene cloning and manipulation*. Cambridge University Press.
4. Sambrook J. and Russel D. (2001). Molecular Cloning - a Laboratory Manual. 3rd Edition. Cold Spring Harbor Laboratory Press.
5. Singh, B. D. and Singh, B. D. (2007). *Biotechnology Expanding Horizons*. Kalyani Publishers.
6. Xu, Y. (2010). *Molecular Plant Breeding*. CABI.

FAR WESTERN UNIVERSITY
Faculty of Agriculture

Course Code	**AGR521**
Course Title	**Principles and Practices of Organic Farming**
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 underlying principles and practices of organic farming, current practices, provision and policies in this sector, identify key stakeholders, apply organic approach into practice and identify the major organic commodities for cultivation, promotion and management in Nepal.
Course Description
Basics of organic farming, Land use in agriculture production; Organic approaches to soil fertility management; Organic approach to weed, disease and pest management; Organic crop and animal production technologies; Various models of organic farming adopted worldwide and in Nepal; Cimate change and organic farming; Various organic standards and organizations involved on it; Policies, provisions and practices for promoting organic agriculture in Nepal; Organic farming for production sustainability and food security; Recent advances in organic farming for food safety and community wellness.

Course Breakdown (Theory)		
SN	**Course Outline**	**Lectures**
1	**Basics of Organic Farming**	
1.1	Definition, history, concept, principles; Global scenario of organic farming	1
1.2	Chemical/pesticide pollution; Importance, scope and limitations of organic farming in maintaining the global and Nepalese food security	1
1.3	Conventional Vs Organic Farming; Basic components of organic farming	1
2	**Land Use in Agriculture Production**	
2.1	Land as source of production and asset; Scenario of land use in Nepal; Land use Act, Policies, Provisions and Practices of Land	1

	use in Nepal	
2.2	Scope of organic agriculture and its relevance to Nepal; Perception regarding land in organic farming, suitable land for organic agriculture	1
3	**Organic Approach to Soil Fertility Management**	
3.1	Important aspects of soil management in organic farming; Role of organic matter in soil fertility and productivity; Integrated nutrient management (INM) and balance fertilization	1
3.2	Integrated Plant Nutrient Supply System (IPNS); Soil organic matter content; Organic sources of nutrients (Biofuel crops, crop rotation, inter-cropping, green manures, cover crops, crop residue management, bio-fertilizers, mulching, organic manures, waste recycling, Compost and FYM, Vermi-compost, Organic fertilizers)	1
3.3	Indigenous technical knowledge (soil, nutrient, water management), problems and prospects in organic agriculture; Soil micro-organisms/ soil biology	1
4	**Organic Approach to Weed, Disease and Pest Management**	
4.1	Identification of field plants and learn about their uses; Identification of pests and beneficial organisms	1
4.2	History of chemical weed and pest management, present trend of agro-chemical use and health hazard to human and nature	1
4.3	Maintaining biodiversity for insect, disease, weed management; Non-chemical approach to weed management (prevention, cultural practices, competitive crops, cover crops, biological weed management, bio-herbicide use)	1
4.4	Biological and indigenous methods for disease management; Organic method for insect-pests management	1
4.5	Global status of pesticide production and application; Trade and politics in agro-chemicals	1
5	**Organic Crop Production**	
5.1	Varietal improvement, seed selection and seed banking (seed requirements and standards for organic crop production in Nepal; Key organic seed producers in Nepal and abroad)	1
6	**Organic Animal Production**	
6.1	Principles and scope of Organic Animal Production in Nepal	1
6.2	Modern Vs Organic Animal Production	1
7	**Various Models of Organic Farming**	
7.1	Natural Farming, Permaculture, Ecological Farming and their	1

	differences and similarities, DEED model in managing organic resources in farmer's field	
8	**Climate Change and Organic Farming**	
8.1	Dry land agriculture and its challenges; Dry land organic agriculture	1
8.2	Climate Smart Agriculture (CSA) and its scope in producing organics in Nepal	1
9	**Policies, Provisions and Practices for promoting Organic Agriculture in Nepal**	
9.1	Policies and provisions for promoting organic agriculture in Nepal	1
9.2	Agencies and Institutions related to organic agriculture in Nepal and abroad	1
9.3	National and International status of organic farming; Key organic products	1
10	**Organic Products Quality and Standards**	
10.1	National standards for organic products; Need and Criteria for organic product qualification	1
10.2	Organic certification and accreditation process	1
10.3	Processing, leveling, economic considerations and viability of organic produce	1
10.4	Organic products marketing and export potential	1
11	Organic farming for production sustainability and food security in Nepal	1
12	Recent advances in organic farming for food safety and community wellness	2
13	Organic production of representative agronomic crops (cereals, legumes, oilseeds, potato and other NUS)	1
	Total	**30**

Course Breakdown (Practical)		
SN	**Course Outline**	**Lectures**
1	Preparation of vermi-compost at lab scale from various kinds of agro-waste	1
2	Preparation of Jholmal, Compost (rural/urban) and Botanical pesticide	1
3	Maintenance of bio-fertilizer strains, culture of bio-fertilizers and their applications	1
4	Organic Vs Inorganic cultivation and comparison of same crop	1

5	Comparison of the structure of soil in traditional and organic farming	1
6	Study of indigenous practices in organic fertilizer management	1
7	Identification of local plant resources and indigenous practices for insect pest management (standing crops and stored seeds) in your locality	1
8	Test the effectiveness of biological products in pest and disease control- summer season [student should bring their own idea (different student different test)]	1
9	Measure of soil health differences based on soil biota in chemically and organically managed soil	1
10	Study the nutritive value of foods produced in organically Vs chemically managed soil	1
11	Identification and listing of different institutions working in organic production and marketing in Nepal and their major roles and responsibilities	1
12	Study of policies and incentives related to organic agriculture in Nepal and in your Palika	1
13	Identification of beneficial and harmful plants, insects and micro-organisms in the field	1
14	Analysis of organic input and flow of a farm enterprise using DEED model	1
15	Visit to organic farm nearby the college	1
	Total	**15**

Recommended Reading Materials

1. Bhandari, D.R. (2063). *A Hand Book of Organic Agriculture*. Janaki Bhandar, Rupandehi.
2. Dahal, K. R., Sharma, K. P., Bhandari, D. R. and Regmi, B. D. (2015). *Organic Farming for Sustainable Agriculture*, Nandwani**,** Dilip (Ed.) Springer 137:168.
3. Eyhorn, F., Heeb, M. and Weidmann, G. (2002). *Training Manual for Organic Agriculture in the Tropic*. International federation of Organic Agricultural movement (IFOAM), Germany.
4. Jaisi, S. (2062). *An Introduction to Organic Farming (in Nepali)*. Treta Agro-concern Pvt. Ltd, Nawalparasi, Nepal.
5. Joshi, M and. Pravakarasethi, T. K. (2006). *Sustainability through Organic Farming*. Kalyani Publishers, India.

6. Mansata, B. (2008). *Organic Revolution! The Agricultural Transformation of Cuba since 1990*. Earthcare Books, Kolkata, India.
7. Mansata, B. (2010). *The vision of Natural Farming*. Earthcare Books, Kolkata, India.
8. Sharma, K.P. and K.R. Dahal. (2017). *Sustainable Agriculture Development in Nepal*: *Need for Paradigm Shift in Theory and Practice*. Chapter 4. IIDS at Kathmandu University (2017). Nepal Economic Outlook Special Edition: Selected Essays on Nepali Economy. Kathmandu.
9. Periodicals and News Letters published by IFOAM, BiFL, ILEA, Slow Food, Grain, etc.
10. Periodicals and News Letters published by NPG, USC Nepal, World Neighbor, World Vision, ICIMOD, HELVETAS and related I/NGOs in the country.

FAR WESTERN UNIVERSITY
Faculty of Agriculture

Course Code	**SSC520**
Course Title	**Soil Conservation and Watershed Management**
Credit Hours	**2 (2+0)**
Full Marks	**50**
Theory (Marks)	**50**
Practical (Marks)	**00**

Objective (s) of the Course
Upon completion of this course, students will understand various types of soil erosion and land degradation and mechanisms involved there in, and measures to be taken for controlling soil erosion to conserve soil and water.
Course Description
Introduction: Importance of soil conservation, soil erosion: causes of soil erosion; Mechanics of soil erosion by water: Definition, types of water erosion; Sediments movement in channels, factors affecting water erosion, wind erosion: Definition and processes; Landslides and Mass wasting; Estimation and monitoring of soil loss, soil erosion control and control measures; Land capability classification of soil, conservation measures, bio-engineering techniques; Concept of watershed management and soil conservation planning; Present status of soil conservation and watershed management in Nepal.

Course Breakdown (Theory)		
SN	**Course Outline**	**Lectures**
1	Introduction to soil conservation: Erosion, population and food supply	1
2	Definition and types of soil erosion	1
3	Causes of soil erosion	1
4	Consequences of soil erosion.	1
5	Desertification: Causes and processes in Nepal	1
6	Types of water erosion	1
7	Sediments movement in channels	1
8	Factors affecting water erosion	1
9	Landslides and mass wasting: Causes and control measures	1
10	Soil erosion by wind: Mechanics of wind erosion	1
11	Types and factors affecting wind erosion	1
12	Soil erosion monitoring and estimation: Simple visual methods	1

13	Runoff plot monitoring and sedimentation survey	1
14	Empirical methods for soil loss estimation: Rainfall factor	1
15	Erodibility factor and length or slope length factor	1
16	Slope gradient factor, crop management factor and conservation practice factor	1
17	Land Use Capability Classification (LCC) of soil	1
18	Importance of LCC	1
19	Soil conservation: Definition and approaches	1
20	Agronomical approaches of soil conservation: Mulching, Liming, fertilizing, green manuring and organic manuring, cover crops, soil depleting, soil conserving and soil building crops	1
21	Soil management: Organic matter content, tillage practices, farm drainage	1
22	Mechanical soil conservation: Terracing	1
23	Soil conservation practices on farm land, pastures, forests and urban areas	1
24	Sloping Agricultural Land Technology (SALT)	1
25	Bioengineering Techniques: Introduction and functions of bio-engineering measures	1
26	Comparison of bio-engineering with conventional approaches	1
27	Concept, objectives and watershed characteristics	1
28	Causes of watershed degradation	1
29	Watershed management planning and integrated watershed management; Water harvesting techniques	1
30	Present status of soil conservation and watershed management in Nepal	1
	Total	**30**

Recommended Reading Materials

1. Bennett, H. H. (2014). *Elements of Soil Conservation (2nd ed.)*. McGraw-Hill Book Company. New York.
2. Brook, K. N., Flolliott, P. F., Gregersen, H. M. and Thames, J. L. (1991). *Hydrology and the Management of Watershed*. Iowa University Press, USA.
3. FAO. (1997). *Guidelines for Watershed Management*. FAO. Field Manual.
4. Kumar, M. (2012). *Crop Management and Soil Conservation*. Pragun Publications.
5. Murty, V. V. N. (1985). *Land and Water Management Engineering*. Kalyani Publishers, New Delhi.

6. Shukla, A. K., Khatri-Chetri, T. B and Pandit, K. N. (1991). *Laboratory Manual of Soil and Water conservation*. Institute of Agriculture and Ani mal Science, Chitwan, Nepal.
7. Tripathi, R. P. and Singh, H.P. (1993). *Soil Erosion and Conservation*. Wiley Eastern Ltd. New Delhi.
8. Wani, S. P., Rockstrom, J. and Sahrawat, K.L. (2011). *Integrated Watershed Management in Rainfed Agriculture*. CRC Press, New York.

FAR WESTERN UNIVERSITY
Faculty of Agriculture

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 5^{th}, 6^{th} and 7^{th} 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 7^{th} 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.