Curriculum Of Technical Subject Group

Higher Secondary Level

(Grade XI & XII)

2015

Plant Science

Higher Secondary Education Board

Curriculum & Training Division

Sanothimi, Bhaktapur

Higher Secondary Education Board
Curriculum of grade 11 and 12

PLANT SCIENCE STREAM

SYNOPSIS

INTRODUCTION

Specialized subjects of the Plant science stream include altogether 6 subjects with 200 Full Marks in grade 11 and 200 full marks in grade 12. The subjects covered include: commercial fruit production and orchard management; food crops production and food security; and participatory agriculture extension and marketing in grade 11 while in grade 12 specialized subjects include: commercial vegetable production and marketing; commercial mushroom production and marketing; and sustainable integrated nutrient and pest management. These subjects with full marks in theory and practical and total full marks are summarized in tables given below.

Specialized subjects for Grade 11

S.N	Name of Subject	Full marks		Total
		Theory	Practical	
1	Commercial fruit production and orchard management	30	45	75
2	Food crops production and food security	30	45	75
3	Participatory agriculture extension and marketing	30	20	50
	Total	**90**	**110**	**200**

Specialized subjects for Grade 12

S.N	Name of Subject	Full marks		Total
		Theory	Practical	
1	Commercial vegetable production and marketing	30	45	75
2	Commercial mushroom production and marketing	20	30	50
3	Sustainable integrated nutrient and pest management (SINPM)	30	45	75
	Total	**80**	**120**	**200**

OBJECTIVES OF THESE COURSES:

- To impart knowledge about the importance and scope of fruit production and grading.
- To enable students classify the important fruits and orchard management.
- To impart knowledge about the cultivation practices for commercial fruit production.

- To understand the importance and concept of food crops (cereals, oil seeds, and grain legumes) and their agro-ecology as well as modern production technology.
- To understand the role and importance of food crops (cereals, oil seeds, grain legumes) in ensuring food security.
- To impart pertinent and basic information of extension covering cooperatives and marketing.
- To enable the students to use common methods, practices and approach of extension for better agricultural development and innovation.
- To impart knowledge the importance and scope of vegetable production and marketing.
- To enable the students classify the vegetable and its management.
- To impart knowledge and concept of cultivation practices of commercial vegetable production.
- To impart knowledge about the importance and scope and skill of mushroom production and marketing.
- To impart knowledge classify the mushroom and skill for its management.
- To develop skill of the students for cultivation practices of commercial mushroom production.
- To enable students to conceptualize and practice integrated plant nutrients management in major field crops and vegetable crops grown in Nepal
- To enable the students to conceptualize and practice integrated pest management in major field crops and vegetable crops grown in Nepal

EXPECTED OUTCOME

- The knowledge, concept, skill and capability of the students is developed to understand, interpret and practice the technological innovations in regard to food crops, vegetables, fruits and mushroom m production at commercial scale.

- The knowledge, concept, and skill of the students is developed to understand, interpret and practice agricultural extension and communication methods at grassroots level.

- The knowledge, concept, and skill of the students is developed to understand, interpret and practice sustainable integrated plant nutrient management and integrated pest management approaches in farming practices.

CAREER AND EMPLOYMENT OPPORTUNITIES

After completing these courses the students will have the following career and job opportunities:

- Will be able to get enrolled in Bachelor of Science in Agriculture and Bachelor of Veterinary Science and Animal Husbandry in various universities both in Nepal and abroad.

- Will be able to get employed in various sectors like GOs, I/NGOs, Private organisations, and enterprises engaged in agricultural and rural development, agro-enterprises.

- Will be able to run own agro-enterprises or production farms at local level.

CURRICULUM

Grade Eleven (Plant science stream)

Subjects

A. Core subjects (FM 400)

1. English
2. Physics
3. Chemistry
4. Biology

B. Specialized subjects (200 Marks)

S.N	Name of Subject	Full marks		Total
		Theory	Practical	
1	Commercial fruit production and orchard management	30	45	75
2	Food crops production and food security	30	45	75
3	Participatory agriculture extension and marketing	30	20	50
	Total	**90**	**110**	**200**

Commercial Fruit Production and Orchard Management

Full Marks: 75 (30T + 45P)
Pass Marks: 11T + 18P
Periods per week: 2T + 2P
Teaching Hours: 96 [Theory (T) 37 + Practical (P) 59]

1. INTRODUCTION:

This course consists of knowledge and skills related to commercial fruit production and grading. It gives detail knowledge of good cultivation practices for commercial fruit production and grading in Nepal.

Theory

Importance, scope and potentiality of fruit production in relation to local as well as international markets. Constraints in commercial fruit production and possible remedies. Agro- climate zone in fruit production in Nepal. Detail description of cultivation practices, including postharvest handling of major fruits crops such as : Mango, Banana , Litchi, Pineapple, Citrus (mandarin, sweet orange, lime, lemon, pummelo), Pomegranate, Grape , Guava , Papaya , Apple , Peach, Plum, pear, apricot, Walnut, Peanut, Chestnut, Kiwifruit, Strawberry.

Practical

Study of different feature of an orchard, Nomenclature of fruit plants, Horticultural classification of fruits crops, Tools and implements used in horticulture, Planning and lay – out of orchard, Preparation of Nursery beds, Procurement of nursery plants and planting in orchard, Study of bearing habits of fruits crops, Training of deciduous fruit trees, Pruning of fruit trees, Weeds and their management in fruit crops, Manuring and fertilization of fruit crops, Identification and management of nutritional deficiencies in fruit crops, To study different methods of irrigation of fruit crops and their layout, Uses of plant growth regulators in fruit crops, Judgment of harvest maturity in fruit crops, Grading , packaging and storage of fruit crops, Processing of fruit (Jam , Jelly , Candy , etc.).Visit of fruit orchard.

II. OBJECTIVES:

- To impart knowledge about the importance and scope of fruit production and grading.
- To enable students classify the important fruits and orchard management.
- To impart knowledge about the cultivation practices for commercial fruit production.

III. COURSE CONTENTS BREAKDOWN THEORY

Specific objectives	**Commercial fruit production and orchard Management (Theory)**	**37 hour**
• To know about the important	**Unit 1.**	**2**

and scope of fruit production in Nepal. • To know about the potentiality of commercial fruit production in Nepal	1.1 Importance and scope 1.2 Potentiality of fruit production in relation to local as well as international markets. 1.3 Constraints in commercial fruit production and possible remedies. 1.4 Classification of fruit on the basis of agro climatic region	
• To import the knowledge of improved culture practices of mango. • To import the knowledge of management practices of mango orchard. • To import the knowledge of postharvest practices of mango	**Unit 2:** **Cultivation Practices of Mango** 2.1 Introduction, Composition and uses, Origin and distribution. 2.2 . The Species and Cultivars, Soil and climate, Area and production, Propagation methods. 2.3 . The Cultivation practices (System of planting, preparation of pits, planting and protection of plant, Irrigation, manuring and fertilization, Training and pruning, Inter cropping and cover cropping, Intercultural operation). 2.4 . The Flowering, Pollination and fruit set. 2.5 . The Fruit growth and development. 2.6 . The Bearing habit. 2.7 . The insect, Pests, Diseases and physiological disorder. **2.8** . The harvesting (Stage of maturity, method of harvesting), yield, grading, packaging, transports and storage.	**3**

• To import the knowledge of improved culture practices of Banana. • To import the knowledge of management practices of banana orchard. • To import the knowledge of postharvest practices of banana	**Unit 3 :** **Cultivation Practices of Banana,** 3.1 Introduction, Composition and uses, Origin and distribution. 3.2 . The Species and Cultivars, Soil and climate, Area and production, Propagation methods. 3.3 . The Cultivation practices (System of planting, preparation of pits, planting and protection of plant, Irrigation, manuring and fertilization, Training and pruning, Inter cropping and cover cropping, Intercultural operation). 3.4 . The Flowering, Pollination and fruit set. 3.5 . The Fruit growth and development. 3.6 . The Bearing habit. 3.7 . The insect, Pests, Diseases and physiological disorder. 3.8 . the harvesting (Stage of maturity, method of harvesting), yield, grading, packaging , transports and storage .	**3**

• To import the knowledge of improved culture practices of Litchi. • To import the knowledge of management practices of litchi orchard. • To import the knowledge of postharvest practices of litchi	**Unit 4:** **Cultivation Practices of Litchi,** 4.1 Introduction, Composition and uses, Origin and distribution. 4.2 . The Species and Cultivars, Soil and climate, Area and production, Propagation methods. 4.3 . The Cultivation practices (System of planting, preparation of pits, planting and protection of plant, Irrigation, manuring and fertilization, Training and pruning, Inter cropping and cover cropping, Intercultural operation). 4.4 . The Flowering, Pollination and fruit set. 4.5 . The Fruit growth and development. 4.6 . The Bearing habit. 4.7 . The insect, Pests, Diseases and physiological disorder. 4.8 . The harvesting (Stage of maturity, method of harvesting), yield, grading, packaging , transports and storage .	**2**

• To import the knowledge of improved culture practices of Pineapple . • To import the knowledge of management practices of pineapple orchard. • To import the knowledge of postharvest practices of pineapple	**Unit 5:** **Cultivation Practices of Pineapple** , 5.1 Introduction, Composition and uses, Origin and distribution. 5.2 . The Species and Cultivars, Soil and climate, Area and production, Propagation methods. 5.3 . The Cultivation practices (System of planting, preparation of pits, planting and protection of plant, Irrigation, manuring and fertilization, Training and pruning, Inter cropping and cover cropping, Intercultural operation). 5.4 . The Flowering, Pollination and fruit set. 5.5 . The Fruit growth and development. 5.6 . The Bearing habit. 5.7 . The insect, Pests, Diseases and physiological disorder. 5.8 . The harvesting (Stage of maturity, method of harvesting), yield, grading, packaging , transports and storage .	**2**

• To import the knowledge of improved culture practices of citrus. • To import the knowledge of management practices of citrus orchard. • To import the knowledge of postharvest practices of citrus	**Unit 6 :** **Cultivation Practices of Citrus(mandarin , sweet orange , lime , lemon, pummelo),** 6.1 Introduction, Composition and uses, Origin and distribution. 6.2 . the Species and Cultivars, Soil and climate, Area and production, Propagation methods. 6.3 . the Cultivation practices (System of planting, preparation of pits, planting and protection of plant, Irrigation, manuring and fertilization, Training and pruning, Inter cropping and cover cropping, Intercultural operation). 6.4 . the Flowering, Pollination and fruit set. 6.5 . the Fruit growth and development. 6.6 . the Bearing habit. 6.7 . the insect, Pests, Diseases and physiological disorder. **6.8** . the harvesting (Stage of maturity, method of harvesting), yield, grading, packaging , transports and storage .	**3**

• To import the knowledge of improved culture practices of Pomegranates. • To import the knowledge of management practices of Pomegranates orchard. • To import the knowledge of postharvest practices of Pomegranates.	**Unit 7:** **Cultivation practices of Pomegranates** 7.1 Introduction, Composition and uses, Origin and distribution. 7.2 . The Species and Cultivars, Soil and climate, Area and production, Propagation methods. 7.3 . The Cultivation practices (System of planting, preparation of pits, planting and protection of plant, Irrigation, manuring and fertilization, Training and pruning, Inter cropping and cover cropping, Intercultural operation). 7.4 . The Flowering, Pollination and fruit set. 7.5 . The Fruit growth and development. 7.6 . The Bearing habit. 7.7 . The insect, Pests, Diseases and physiological disorder. **7.8** . The harvesting (Stage of maturity, method of harvesting), yield, grading, packaging , transports and storage .	**2**
• To import the knowledge of improved culture practices of Grape. • To import the knowledge of management practices of grape orchard. • To import the knowledge of postharvest practices of grape.	**Unit 8:** **Cultivation Practices of Grape,** 8.1 Introduction, Composition and uses, Origin and distribution. 8.2 . The Species and Cultivars, Soil and climate, Area and production, Propagation methods. 8.3 . The Cultivation practices (System of planting, preparation of pits, planting and protection of plant, Irrigation, manuring and fertilization, Training and pruning, Inter	**3**

	cropping and cover cropping, Intercultural operation). 8.4 . The Flowering, Pollination and fruit set. 8.5 . The Fruit growth and development. 8.6 . The Bearing habit. 8.7 . The insect, Pests, Diseases and physiological disorder. 8.8 . The harvesting (Stage of maturity, method of harvesting), yield, grading, packaging , transports and storage .	
• To import the knowledge of improved culture practices of guava. • To import the knowledge of management practices of guava orchard. • To import the knowledge of postharvest practices of guava.	**Unit 9:** **Cultivation Practices of Guava**, 9.1 Introduction, Composition and uses, Origin and distribution. 9.2 . The Species and Cultivars, Soil and climate, Area and production, Propagation methods. 9.3 . The Cultivation practices (System of planting, preparation of pits, planting and protection of plant, Irrigation, manuring and fertilization, Training and pruning, Inter cropping and cover cropping, Intercultural operation). 9.4 Flowering, Pollination and fruit set. 9.5 Fruit growth and development. 9.6 Bearing habit. 9.7 Insect, Pests, Diseases and physiological disorder. 9.8 Harvesting (Stage of maturity, method of harvesting), yield, grading, packaging , transports and storage .	**2**

• To import the knowledge of improved culture practices of Papaya. • To import the knowledge of management practices of Papaya orchard. • To import the knowledge of postharvest practices of Papaya.	**Unit 10:** **Cultivation Practices of Papaya**, 10.1 Introduction, Composition and uses, Origin and distribution. 10.2 Species and Cultivars, Soil and climate, Area and production, Propagation methods. 10.3 Cultivation practices (System of planting, preparation of pits, planting and protection of plant, Irrigation, manuring and fertilization, Training and pruning, Inter cropping and cover cropping, Intercultural operation). 10.4 Flowering, Pollination and fruit set. 10.5 Fruit growth and development. 10.6 Bearing habit. 10.7 Insect, Pests, Diseases and physiological disorder. 10.8 Harvesting (Stage of maturity, method of harvesting), yield, grading, packaging , transports and storage .	**2**

• To import the knowledge of improved culture practices of Apple . • To import the knowledge of management practices of Apple orchard. • To import the knowledge of postharvest practices of Apple.	**Unit 11:** **Cultivation Practices of** Apple 11.1 Introduction, Composition and uses, Origin and distribution. 11.2 Species and Cultivars, Soil and climate, Area and production, Propagation methods. 11.3 Cultivation practices (System of planting, preparation of pits, planting and protection of plant, Irrigation, manuring and fertilization, Training and pruning, Inter cropping and cover cropping, Intercultural operation). 11.4 Flowering, Pollination and fruit set. 11.5 Fruit growth and development. 11.6 Bearing habit. 11.7 Insect, Pests, Diseases and physiological disorder. 11.8 Harvesting (Stage of maturity, method of harvesting), yield, grading, packaging , transports and storage .	**2**

• To import the knowledge of improved culture practices of Plum, Peach , pear and Apricot . • To import the knowledge of management practices of Plum, Peach , pear and Apricot orchard. • To import the knowledge of postharvest practices of Plum, Peach , pear and Apricot .	**Unit 12:** **Cultivation Practices of Plum, Peach , pear and Apricot** 12.1 Introduction, Composition and uses, Origin and distribution. 12.2 Species and Cultivars, Soil and climate, Area and production, Propagation methods. 12.3 Cultivation practices (System of planting, preparation of pits, planting and protection of plant, Irrigation, manuring and fertilization, Training and pruning, Inter cropping and cover cropping, Intercultural operation). 12.4 Flowering, Pollination and fruit set. 12.5 Fruit growth and development. 12.6 Bearing habit. 12.7 Insect, Pests, Diseases and physiological disorder. 12.8 Harvesting (Stage of maturity, method of harvesting), yield, grading, packaging, transports and storage.	**2**

• To import the knowledge of improved culture practices of Walnut ,Pecanut and Chestnut . • To import the knowledge of management practices of Walnut ,Pecanut and Chestnut orchard. • To import the knowledge of postharvest practices of Walnut ,Pecanut and Chestnut	**Unit 13:** **Cultivation Practices of** Walnut ,Pecanut and Chestnut 13.1 Introduction, Composition and uses, Origin and distribution. 13.2 Species and Cultivars, Soil and climate, Area and production, Propagation methods. 13.3 Cultivation practices (System of planting, preparation of pits, planting and protection of plant, Irrigation, manuring and fertilization, Training and pruning, Inter cropping and cover cropping, Intercultural operation). 13.4 Flowering, Pollination and fruit set. 13.5 Fruit growth and development. 13.6 Bearing habit. 13.7 Insect, Pests, Diseases and physiological disorder. 13.8 Harvesting (Stage of maturity, method of harvesting), yield, grading, packaging , transports and storage .	**2**

• To import the knowledge of improved culture practices of Kiwi fruit . • To import the knowledge of management practices of Kiwi fruit orchard. • To import the knowledge of postharvest practices of Kiwi fruit.	**Unit 14:** **Cultivation Practices of** Kiwi fruit, 14.1 Introduction, Composition and uses, Origin and distribution. 14.2 Species and Cultivars, Soil and climate, Area and production, Propagation methods. 14.3 Cultivation practices (System of planting, preparation of pits, planting and protection of plant, Irrigation, manuring and fertilization, Training and pruning, Inter cropping and cover cropping, Intercultural operation). 14.4 Flowering, Pollination and fruit set. 14.5 Fruit growth and development. 14.6 Bearing habit. 14.7 Insect, Pests, Diseases and physiological disorder. 14.8 Harvesting (Stage of maturity, method of harvesting), yield, grading, packaging , transports and storage .	**2**

• To import the knowledge of improved culture practices of strawberry. • To import the knowledge of management practices of strawberry orchard. • To import the knowledge of postharvest practices of strawberry.	**Unit 15:** **Cultivation Practices of** Strawberry 15.1 Introduction, Composition and uses, Origin and distribution. 15.2 Species and Cultivars, Soil and climate, Area and production, Propagation methods. 15.3 Cultivation practices (System of planting, preparation of pits, planting and protection of plant, Irrigation, manuring and fertilization, Training and pruning, Inter cropping and cover cropping, Intercultural operation). 15.4 Flowering, Pollination and fruit set. 15.5 Fruit growth and development. 15.6 Bearing habit. 15.7 Insect, Pests, Diseases and physiological disorder. 15.8 Harvesting (Stage of maturity, method of harvesting), yield, grading, packaging , transports and storage .	**3**
• To import the knowledge of improved culture practices of Lapsi . • To import the knowledge of management practices of lapsi orchard. • To import the knowledge of postharvest practices of lapsi fruit.	**Unit 16:** **Cultivation practices of Lapsi** 16.1 Introduction, Composition and uses, Origin and distribution. 16.2 Species and Cultivars, Soil and climate, Area and production, Propagation methods. 16.3 Cultivation practices (System of planting, preparation of pits, planting and protection of plant, Irrigation, manuring and fertilization, Training and pruning, Inter cropping and cover cropping, Intercultural operation).	**2**

	16.4 Flowering, Pollination and fruit set. 16.5 Fruit growth and development. 16.6 Bearing habit. 16.7 Insect, Pests, Diseases and physiological disorder. **16.8** Harvesting (Stage of maturity, method of harvesting), yield, grading, packaging , transports and storage .	

IV. Course contents Practical

	Commercial fruit production and grading	**59 hours**
1	Study of different feature of an orchard	**2**
2	Nomenclature of fruit plants	**2**
3	Horticultural classification of fruits crops	**2**
4	Tools and implements used in horticulture	**2**
5	Planning and lay – out of orchard	**2**
6	Preparation of Nursery beds	**3**
7	Procurement of nursery plants and planting in orchard	**2**
8	Study of bearing habits of fruits crops	**3**
9	Training of deciduous fruit trees	**4**
10	Pruning of fruit trees	**5**
11	Weeds and their management in fruit crops	**4**
12	Manuring and fertilization of fruit crops	**4**
13	Identification and management of nutritional deficiencies in fruit crops	**4**
14	To study different methods of irrigation of fruit crops and their layout	**4**
15	Uses of plant growth regulators in fruit crops	**4**
16	Judgment of harvest maturity in fruit crops	**4**
17	Grading , packaging and storage of fruit crops	**4**
18	Visit of fruit orchard	**4**

V. INSTRUCTIONAL MATERIALS:

- To be guided by Teaching Manual

VI. INSTRUCTIONAL TECHNIQUES:

- To be guided by Teaching Manual

VII. MARKS AND HOURS DISTRIBUTION (all units should have equal marks)

- To be guided by Teaching Manual

VIII. EVALUATION SCHEMES

a.Theory Evaluation:

S. No.	Topics	No. of Questions	Marks	Total
1	Very Short Questions	5	1	**5**
2	Short Questions	5	4	**20**
3	Long Question (Analytical)	1	5	**5**
	Total			**30**

b. Practical Evaluation:

Internal Evaluation Marks	External Evaluation Marks
25	20

Lab Exercises are guided by marks distribution and Teaching Manual.

Practical Internal Examination Evaluation Scheme (25 Marks)

Internal evaluation will be conducted by course teacher based on following activities:

1) Attendance and Class Performance	2 Marks
2) Lab/Field/Case Study Report	3 Marks
3) Practical First Exam	10 Marks
4) Practical Second Exam	10 Marks
Total	25 Marks

Practical External Examination Evaluation Scheme (20 Marks)

1) Practical Exam	15 Marks
2) Viva voce	5 Marks
Total	20 Marks

IX. Reference Books

Bhattarai, B.P. and S. Sharma. 2010. Fundamental of Horticulture, A practical manual. Himalayan College of Agricultural Sciences and Technology (HICAST) , Kathmandu, Nepal.

Shrestha, G.K. , S.M., Shaykya , D.R. Baral and D.M. Gautam . 2001 . Fundamental of Horticulture . Delta offset press , Kathmandu , Nepal .

Bose, T.K. , S.K. Mitra and D. Sanyal. 2002. Fruits: Tropical and subtropical volume I &II . Naya Udyog. Calcutta.

Mitra, S.K. , D.S. Rathora and T.K. Bose. 1991. Temperate fruits. Horticulture and Allied Publisher , Calcutta, India .

Chattapadhyay T.K. 2012. A Text book of Pomology (Subtropical fruits). Kalyani publishers, India

Chattapadhyay T.K. 2012. A Text book of Pomology (Tropical fruits). Kalyani publishers, India

Singh , S.P. 2004. Commercial fruits . A. Kalyani publishers, India

Food Crops Production and Food Security

Full Marks: 75 (30T + 45P)
Pass Marks: 11T + 18P
Periods per week: 2T + 2P
Teaching Hours: 96 [Theory (T) 37 + Practical (P) 59]

I. INTRODUCTION

Course description: This course consists of basic knowledge and skills related to production of major food crops and their role in ensuring food security.

Theory

Definitions of: subsistence, commercial and sustainable agriculture. Importance and scope of food crops for food and nutritional security. Nutritional advantage of food crops in Nepal. Geographical distribution of food crops in Nepal. Distribution, area, response to climatic conditions and soil of food crops (cereal, oil seed crops and grain legume crops). Varieties, land preparation / nursery management, application of fertilizers and manure, seed treatment, time and method of sowing, cropping systems: system of rice intensification (SRI), intercropping; irrigation, weed management, common insect pests, diseases, harvesting, threshing, yield, storage and marketing of production of food crops (cereal, oil seed crops and grain legume crops). Definition and concept of food and nutritional security in global, regional and national context. Food security and nutritional advantage of food crops in Nepal. Various dimensions of food security: Factors affecting food security.

Practical

Identification of seed and plants of food crops. Calculation of doses and application of fertilizers and manures. Collection and identification of common weeds of selected food crops. Collection and identification of common insect pests of the food crops. Collection and identification of disease infected parts of the food crops. Preparation of cropping patterns and crop rotations for lowland and upland conditions of terai and hills.

II. **OBJECTIVES**:

Upon successful completion of his course, the students will be able:

- To state importance and concept of food crops (cereals, oil seeds, and grain legumes) and their agro-ecology as well as practice modern production technology.
- To state the role and importance of food crops (cereals, oil seeds, grain legumes) in ensuring food security.

III. COURSE CONTENTS BREAKDOWN THEORY

Specific Objectives	Contents	Contact Hours (37)
• To know about the important and scope of food crops and nutrient security in Nepal. • To know about the geographical distribution of food crops in Nepal	**Unit 1.** **Introduction** 1.1 Definitions of: subsistence, commercial and sustainable agriculture 1.3 Importance and scope of food crops for food and nutritional security 1.4 Nutritional advantage of food crops in Nepal 1.5 Geographical distribution of food crops in Nepal	**2**
• To import the knowledge of Distribution, importance, area and agro-ecology of cereal crops	**Unit 2.** **Distribution, importance, area and agro-ecology of cereal crops** Distribution, area, response to climatic conditions and soil of the following crops: 2.1. Rice 2.2. Wheat 2.3. Maize 2.4. Finger millet 2.5. Buckwheat 2.6 Barley	**3**
• To import the knowledge of culture practices of cereal crops.	**Unit 3. Cultivation practices of cereal crops (rice, wheat, maize, finger millet, buckwheat and barley)** Varieties, land preparation / nursery management, application of fertilizers and manure, seed treatment, time and method of sowing, cropping systems: system of rice intensification (SRI), intercropping; irrigation, weed management, common insect pests, diseases, harvesting, threshing, yield, storage and marketing of production 3.1. Rice 3.2. Wheat 3.3. Maize 3.4. Finger millet 3.5. Buckwheat 3.6 Barley	**5**

• To import the knowledge of Distribution, importance, area and agro-ecology of oil seed crops .	**Unit 4. Distribution, importance, area and agro-ecology of oil seed crops** Distribution, area, response to climatic conditions and soil of the following crops: 4.1. Rapeseed / mustard 4.2. Sesame 4.3. Groundnut	**5**
• To import the knowledge of culture practices of oil seed crops.	**Unit 5. Cultivation practices of oil seed crops** Variety, land preparation, application of fertilizer and manure, seed treatment, time and method of sowing, irrigation, weed management, common insect pest, diseases, harvesting, threshing, drying, yield, storage and marketing 5.1. Rapeseed / mustard 5.2. Sesame 5.3. Groundnut	**5**
• To import the knowledge of Distribution, importance, area and agro-ecology of oil seed crops	**Unit 6. Distribution, importance, area and agro-ecology of oil seed crops** Distribution, area, response to climatic conditions and soil of the following crops: 6.1. Lentil 6.2. Soybean 6.3. Chickpea 6.4. Black / green gram	**5**
• To import the knowledge of culture practices of grain legume crops.	**Unit 7. Cultivation practices of grain legume crops** Variety, land preparation, manure, seed treatment, time and method of sowing, irrigation, weeding, insect pest, disease, harvesting, yield, storage and economics of production of grain legumes. 7.1. Lentil 7.2. Soybean 7.3. Chickpea 7.4. Black / green gram	**5**
• To import the knowledge of concept and dimensions of food security .	**Unit 8. Definition, concept and dimensions of food security** 8.1. Definition and concept of food and nutrition global, regional and national context 8.2. Food security and nutritional advantage of food crops in Nepal	**5**

	8.3. Various dimensions of food security: a. Food production b. Food availability c. Food quality d. Access to food	
• To import the knowledge of factors affecting of food security .	**Unit 9. Factors affecting food security** 9.1. Factors affecting food security a. Social / gender issues b. Ecological c. Technological d. Economic e. Political / policies	**2**

IV. Course contents PRACTICAL

	Practical's	Contact Hours (59)
1	Identification of seed and plants of food crops	2
2	Calculation of doses of fertilizers and manures	3
3	Application of fertilizers and manures in field	4
4	Collection of common weeds of selected food crops	5
5	Identification of collected weeds of selected food crops	6
6	Collection of common insect pests of the food crops	6
7	Identification of common insect pests of the food crops	6
8	Collection of disease infected parts of the food crops	6
9	Identification of collected diseased samples of the food crops	6
10	Preparation of cropping patterns for lowland and upland conditions of terai and hills	8
11	Preparation of scientific crop rotations for lowland and upland conditions of terai and hills for 1-5 years	7

V. INSTRUCTIONAL MATERIALS:

- To be guided by Teaching Manual

VI. INSTRUCTIONAL TECHNIQUES:

- To be guided by Teaching Manual

VII. MARKS AND HOURS DISTRIBUTION (all units should have equal marks)

- To be guided by Teaching Manual

VIII. EVALUATION SCHEMES

a. Theory Evaluation:

S. No.	Topics	No. of Questions	Marks	Total
1	Very Short Questions	5	1	**5**
2	Short Questions	5	4	**20**
3	Long Question (Analytical)	1	5	**5**
	Total			**30**

b. Practical Evaluation:

Internal Evaluation Marks	External Evaluation Marks
25	20

Lab Exercises are guided by marks distribution and Teaching Manual.

Practical Internal Examination Evaluation Scheme (25 Marks)

Internal evaluation will be conducted by course teacher based on following activities:

1. Attendance and Class Performance	2 Marks
2. Lab/Field/Case Study Report	3 Marks
3. Practical First Exam	10 Marks
4. Practical Second Exam	10 Marks
Total	25 Marks

Practical External Examination Evaluation Scheme (20 Marks)

1. Practical Exam	15 Marks
2. Viva voce	5 Marks
Total	20 Marks

IX. REFERENCES BOOKS

1. Rajbhandari, B.P. and Bhatta, G.D. 2008. Food Crops: agro-ecology and modern agro-techniques, HICAST, Kathmandu
2. Rajbhandari, B.P. 2011. Grain legumes of Nepal, HICAST Publication, Kathmandu
3. Rajbhandari, B.P. 1991. Groundnut: biology and production technology, Kathmandu.
4. Rajbhandari, B.P and Shrestha, S. 2014. Crop production and food security in the face of climate change, HICAST, Kathmandu.

Participatory Agriculture Extension and Marketing

Full Marks: 50 (30T + 20P)
Pass Marks: 11T + 8P
Periods per week: 2T + 2P
Teaching Hours: 64 [Theory (T) 44 + Practical (P) 20]

I. INTRODUCTION

Course Description: This course consists of understanding about basics of participatory agriculture extension and marketing. Besides, the course emphasizes to deliver practical knowledge and skills about the common concerns on extension covering communication, cooperatives and marketing. The other important aspects of this course are contemporary agriculture extension, teaching and learning, innovation-decision process, transfer of technology, program planning, monitoring and evaluation, basic sociological concept, role of line agencies. Moreover, this course equally consists of common practical approach and phenomenon of agriculture extension and marketing reflecting learning approach, business plan preparation, and extension aids and tools such as - various kinds of charts- flow, tree, suspense, flip, Brochures, Posters, Leaflets, and Pamphlets.

Theory

Concept of education and extension education; contemporary agriculture extension, and role of extension in agricultural development. Teaching and learning process including extension teaching methods. Methods for community participation- importance, steps and concept of different participatory approaches; commonly used participatory tools- PRA and RRA. Group Led Extension System: Transfer of Technology- system of farming and marketing, diffusion and stages of innovation-decision process, adoption. Extension program planning, monitoring and evaluation- principles, importance and decentralized planning process, evaluation and follow ups. Basic sociological concept- social norms, values and belief, stratification, conflict and its management, exclusion and inclusion. Cooperatives- principles, policies and organizational structures; problems and perspectives, management and cooperative accounting systems, marketing extension and information flow; product planning, processing and packaging, product diversification and value chain; product storage and transportation to the markets and value addition. Concept of gender, roles, needs and gender analysis.

Practical

Baseline survey of rural community and its analysis. Identification and prioritization of farmers' problems. Use of RRA and PRA tools as a qualitative approach of information collection. Develop questionnaire to generate quantitative information. Preparation of farm level production plan: crop production and livestock production and interaction visit and meeting with I/NGO/CBOs/Co-operatives/Private sectors to learn working modality. Conduct case study of a farmer group formed by DADO/ DLSO. Preparation of various kind of charts- flow, tree, suspense, flip, Brochures, Posters, Leaflets, Pamphlets. Preparation of PowerPoint slides and

presentation. Learn about the practices and working modalities of micro-finance and cooperatives in Nepal.

II. OBJECTIVES

- The main objective of this course is to provide pertinent and basic information of extension covering cooperatives and marketing.
- Students will be able to use common methods of practices and approach of extension for better agricultural development and innovation.

III. COURSE CONTENTS BREAKDOWN THEORY

Specific Objectives	Contents	Contact Hours (44)
• To know about the concept and types of education • To know about the characteristics of education	**Unit 1** **Education** 1.1 Meaning, concept, definition, objective of education 1.2 Types of education: formal, non-formal and informal education 1.3 The nature, role and characteristics of non-formal education in rural development	**3**
• To import the knowledge of extension education system in Nepal	**Unit 2** **Extension Education System in Nepal** 2.1 Meaning, concept and definition of extension education 2.2 Role of extension in agriculture development 2.3 Contemporary agricultural extension approaches	**2**
• To import the knowledge of Teaching and Learning Process	**Unit 3** **Teaching and Learning Process** 3.1 Meaning of teaching and learning 3.2 Extension teaching methods: 3.3.Individual approach: personal contact 3.4.Group approach: Method demonstration and Result demonstration 3.5 Mass media approach: Use of audio-visual aids	**3**
• To import the knowledge of Approaches and Methods for Community Participation	**Unit 4** **Approaches and Methods for Community Participation** 4.1 Meaning and definition of participatory	**4**

• To import the knowledge of Group Led Extension System: Transfer of Technology	extension 4.2 Need and importance of community participation 4.3 Concept of different participatory approaches 4.3.1 Rapid Rural Appraisal (RRA) 4.3.2 Participatory Rural Appraisal (PRA) 4.3.3 Farming System Research (FSR) **Unit 5** **Group Led Extension System: Transfer of Technology** 5.1 System of farming and marketing 5.2. Group farming and benefits of groups 5.3. Organic farming and its sustainability 5.4. Farm eco-tourism and its scope 5.5Group led extension; its scope and importance in the rural agriculture 5.6 Meaning of diffusion and stages of innovation-decision process 5.7 Meaning of adoption and classification of adopters 5.8 Factors affecting adoption of innovation	**6**
• To import the knowledge of Extension Program Planning, Monitoring and Evaluation	**Unit 6** **Extension Program Planning, Monitoring and Evaluation** 6.1 Principles and importance of programme planning 6.2 Extension program planning process 6.3 Decentralized program planning process 6.4 Program monitoring, evaluation and follow ups	**5**
• To import the knowledge of Basic Sociological Concept	**Unit 7** **Basic Sociological Concept** 7.1 Meaning and importance of study of sociology and rural sociology 7.2 Concept and meaning of common terminologies 7.3. Social structure 7.4 Social norms and values 7.5 Culture and belief system	**6**

	7.6 Social process and social integration 7.7 Social stratification: caste, class, gender, age 7.8 Conflict and conflict management 7.9 Concept of social exclusion and social inclusion 7.10 Society and socialization	
• To import the knowledge of Group and Rural Leadership	**Unit 8** **Group and Rural Leadership** 8.1 Types of farmers group and process of conducting group meeting 8.2 Meaning and types of leader and leadership 8.3 Role of local leaders in extension education 8.4 Selection and development of local leaders	**3**
• To import the knowledge of Cooperatives and Marketing Extension	**Unit 9** **Cooperatives and Marketing Extension** 9.1 Purpose and the formation of cooperatives 9.2 Principles, policies and guidelines of cooperatives and their organizational structures 9.3 Management and administration of cooperatives societies in Nepal 9.4 Cooperative education and cooperative accounting systems of farmers 9.5 Co-operatization of farmer groups as agri-business organization 9.6 Marketing extension and information flow 9.7 Product planning, processing and packaging 9.8 Product diversification and value chain 9.9 Product storage and transportation to the markets and value addition	**6**
• To import the knowledge of Social Mobilization and Community Development	**Unit 10** **Social Mobilization and Community Development** 10.1 Meaning and process of social mobilization	**3**

	10.2 Actors of Rural development and poverty alleviation programs, linkages and coordination, problems and issues. 10.3 Definition, purposes and process of motivation 10.4 Factors and techniques of motivation for community, farmers and development workers	
• To import the knowledge of gender and development	**Unit 11** **Gender and Development** 11.1 Introduction to gender concept: gender segregation, stratification and discrimination 11.2 Concept of gender equity and equality in relation to power relation 11.3 Gender roles: Productive, reproductive and community 11.4 Identifying gender needs and its importance in rural context	**3**

IV. Course contents Practical

Practical's	**Contact Hours (20)**
1. Conduct a baseline survey into a rural community and analyze the situation	2
2. Identification and prioritization of farmers' problems	2
3. Learn about RRA and PRA tools as a qualitative approach of information collection	2
4. Learn about how to develop questionnaire to generate quantitative information	2
5. Preparation of farm level production plan: crop production and livestock production	2
6. Interaction visit and meeting with I/NGO/CBOs/Co-operatives/Private sectors and its local group and study their plan of work and implementation	2
7. Conduct case study of a farmer group formed by DADO/ DLSO	2
8. Preparation of various kind of charts- flow, tree, suspense, flip, Brochures, Posters, Leaflets, Pamphlets etc	2
9. Preparation of PowerPoint slides and presentation	2
10. Learn about working modality of cooperatives in Nepal	2

V. INSTRUCTIONAL MATERIALS:

- To be guided by Teaching Manual

VI. INSTRUCTIONAL TECHNIQUES:

- To be guided by Teaching Manual

VII. MARKS AND HOURS DISTRIBUTION (all units should have equal marks)

- To be guided by Teaching Manual

VIII. EVALUATION SCHEMES

a.Theory Evaluation:

S. No.	Topics	No. of Questions	Marks	Total
1	Very Short Questions	5	1	**5**
2	Short Questions	5	4	**20**
3	Long Question (Analytical)	1	5	**5**
	Total			**30**

b. Practical Evaluation:

Internal Evaluation Marks	External Evaluation Marks
10	10

Lab Exercises are guided by marks distribution and Teaching Manual.

Practical Internal Examination Evaluation Scheme (25 Marks)

Internal evaluation will be conducted by course teacher based on following activities:

1. Attendance and Class Performance	2 Marks
2. Lab/Field/Case Study Report	3 Marks
3. Practical First Exam	5 Marks
Total	10 Marks

Practical External Examination Evaluation Scheme (20 Marks)

1. Practical Exam	5 Marks
2. Viva voce	5 Marks
Total	10 Marks

IX. REFERENCES BOOKS

Ban, A.W., Van Den and H.S. Hawkins. 1998. Agricultural Extension. S.K.Jain for CBS Publishers and Distributors, New Delhi, Inida

Bhatnagar, O.P. and O.P. Dahama. 2005. Extension and Communication for Development. Oxfordand IBH Publishing Co. Ltd., New Delhi, Inida

Bhusan, V. and D.R. Sachdeva. 2012. An Introduction to Sociology. Kitab Mahal, Allahabad, Inida

Chitambar, J,V. 2015. Introductory Rural Sociology. Wiley Eastern Ltd., India

Dangol, B.B.S. Extension Education. Dongol Printers, Gopal Tole Kathmandu.

Khan, S.S. and J.S. Sah. 2001. Social Mobilization Manual based on Syangja Experience, Social Mobilization Experimentation and Learning Center, UNDP/IAAS, Nepal

Sandhu. A.S. 2004. Textbook on Agricultural Communication Process and Methods. Oxford and IBH.

UNDP. 2001. Governance and Poverty Reduction: National Human Development Report, Kathmandu, Nepal

Grade Twelve (Plant science stream)

Subjects

Core subjects: (FM 400)

1. Nepali / English
2. Physics
3. Chemistry
4. Mathematics

Specialized subjects with theory and practical

S.N	Name of Subject	Full marks		Total
		Theory	Practical	
1	Commercial vegetable production and marketing	30	45	75
2	Commercial mushroom production and marketing	20	30	50
3	Sustainable Integrated nutrient and pest management (INPM)	30	45	75
	Total	**80**	**120**	**200**

Commercial Vegetable Production and Marketing

Full Marks: 75 (30T + 45P)
Pass Marks: 11T + 18P
Periods per week: 2T + 2P
Teaching Hours: 96 [Theory (T) 37 + Practical (P) 59]

I. INTRODUCTION

Course Description: This course consists of knowledge and skills related to commercial vegetable production and marketing of vegetable. It gives detail knowledge of appropriate /good cultivation practices of commercial vegetable production and marketing in Nepal.

Theory

Importance and scope of vegetable crops in Nepal. Potentiality of vegetable production in relation to local as well as international markets. Constraints in commercial vegetable production and possible remedies. Classification of vegetable. Details description of cultivation practices, including postharvest handling and marketing of major vegetable crops such as Cole crops , Roots crops , Leafy vegetable crops , Tuber crops , Legume vegetable crops , fruit vegetable crops , Bulb crops , cucurbitaceous vegetable , Perennial crops, Spices crops .

Practical

Study of different feature of vegetable farming .Tools and implements used in horticulture. Nursery bed preparation and nursery raising of different vegetable crops. Varietal characteristics and identification of major vegetable. Field preparation for vegetable crops. Method of sowing and transplantation of vegetable crops. Method of irrigation for vegetable farming. Intercultural operation (thinning, gap filling, weeding, mulching, earthing up staking) in different vegetable crops . Training and pruning of different vegetable crops. Weeds and their management in vegetable crops . Manuring and fertilization of vegetable crops. Identification and management of nutritional deficiencies in vegetable crops. Judgment of harvest maturity in vegetable crops .Grading , packaging and storage of vegetable crops. Marketing system of vegetable .Processing of vegetable. Visit of commercial vegetable farm. Visit of vegetable market

II. OBJECTIVES: After completion of this subject the students will be able:

- To know the importance and scope of vegetable production and marketing.
- To classify the vegetable and its management.
- To know the concept of cultivation practices of commercial vegetable production.

III. COURSE CONTENTS BREAKDOWN

Specific objectives	**Commercial vegetable production and marketing**	**37 hour**
• To know about the important and scope of vegetable production in Nepal. • To know about the potentiality of	**Unit 1:** **Introduction** 11.1 Importance and scope	**3**

commercial vegetable production in Nepal	1.2 Potentiality of vegetable production in relation to local as well as international markets. 1.3 Constraints in commercial vegetable production and possible remedies. 1.4 Classification of vegetable	
• To import the knowledge of improved culture practices of cole crops . • To import the knowledge of management practices of cultivated filed . • To import the knowledge of postharvest practices of cole crops.	**Unit 2 :** **Cultivation Practices of Cole crops (cauliflower , broccoli, cabbage , knolkhol)** 2.1 Introduction, Composition and uses, Origin and distribution. 2.2 . the Species and Cultivars, Soil and climate, Area and production, Nursery bed preparation. 2.3 . the Cultivation practices (Sowing / transplantation, manuring and fertilization, irrigation, intercultural operation). 2.4 . the insect, Pests, Diseases and physiological disorder and its management. **2.5** . the harvesting (Stage of maturity, method of harvesting), yield, grading, packaging, transports ,storage and Marketing .	**4**
• To import the knowledge of improved culture practices of Root crops • To import the knowledge of management practices of cultivated filed. • To import the knowledge of postharvest practices of Root crops.	**Unit 3 :** **Cultivation Practices of Root crops (Radish , Carrot , turnip)** 3.1 Introduction, Composition and uses, Origin and distribution. 3.2 . the Species and Cultivars, Soil and climate, Area and production, Nursery bed preparation. 3.3 . the Cultivation practices (Sowing / transplantation, manuring and fertilization, irrigation, intercultural operation). 3.4 . the insect, Pests, Diseases and physiological disorder and its management. 3.5 . the harvesting (Stage of maturity, method of harvesting), yield, grading, packaging, transports, storage and Marketing .	**3**

• To import the knowledge of improved culture practices of Leafy vegetable. • To import the knowledge of management practices of cultivated filed. • To import the knowledge of postharvest practices of Leafy vegetable.	**Unit 4:** **Cultivation Practices of Leafy vegetable (Broad leaf mustard ,spinach, swisschard , cress)** 4.1 Introduction, Composition and uses, Origin and distribution. 4.2 . The Species and Cultivars, Soil and climate, Area and production, Nursery bed preparation. 4.3 . The Cultivation practices (Sowing / transplantation, manuring and fertilization, irrigation, intercultural operation). 4.4 . The insect, Pests, Diseases and physiological disorder and its management. 4.5 . the harvesting (Stage of maturity, method of harvesting), yield, grading, packaging, transports, storage and Marketing .	**3**
• To import the knowledge of improved culture practices of Tuber crops • To import the knowledge of management practices of cultivated filed. • To import the knowledge of postharvest practices of Tuber crops.	**Unit 5:** **Cultivation practice of Tuber crops (Potato , sweet potato ,yam , colocasia ,cassava)** 5.1 Introduction, Composition and uses, Origin and distribution. 5.2 . The Species and Cultivars, Soil and climate, Area and production, Nursery bed preparation. 5.3 . The Cultivation practices (Sowing / transplantation, manuring and fertilization, irrigation, intercultural operation). 5.4 . The insect, Pests, Diseases and physiological disorder and its management. **5.5** . The harvesting (Stage of maturity, method of harvesting), yield, grading, packaging, transports, storage and Marketing .	**4**

• To import the knowledge of improved culture practices of Legume vegetable crops . • To import the knowledge of management practices of cultivated filed. • To import the knowledge of postharvest practices of Legume vegetable crops.	**Unit 6:** **Cultivation Practices of Legume vegetable (peas , bean , cowpea)** 6.1 Introduction, Composition and uses, Origin and distribution. 6.2 . the Species and Cultivars, Soil and climate, Area and production, Nursery bed preparation. 6.3 . the Cultivation practices (Sowing / transplantation, manuring and fertilization, irrigation, intercultural operation). 6.4 . the insect, Pests, Diseases and physiological disorder and its management. **6.5** . the harvesting (Stage of maturity, method of harvesting), yield, grading, packaging, transports, storage and Marketing .	**3**
• To import the knowledge of improved culture practices of fruit vegetable crops • To import the knowledge of management practices of cultivated filed. • To import the knowledge of postharvest practices of fruit vegetable crops.	**Unit 7:** **Cultivation practices of fruit vegetable crops (chilies, capsicum, tomato , brinjal , okra)** 7.1 Introduction, Composition and uses, Origin and distribution. 7.2 . the Species and Cultivars, Soil and climate, Area and production, Nursery bed preparation. 7.3 . the Cultivation practices (Sowing / transplantation, manuring and fertilization, irrigation, intercultural operation). 7.4 . the insect, Pests, Diseases and physiological disorder and its management. **7.5** . the harvesting (Stage of maturity, method of harvesting), yield, grading, packaging, transports, storage and Marketing .	**4**
• To import the knowledge of improved culture practices of Bulb crops • To import the knowledge of management practices of cultivated filed. • To import the knowledge of postharvest practices of bulb crops.	**Unit 8:** **Cultural Practices of Bulb crops (onion , garlic, leek)** 8.1 Introduction, Composition and uses, Origin and distribution.	**3**

	8.2 . the Species and Cultivars, Soil and climate, Area and production, Nursery bed preparation. 8.3 . the Cultivation practices (Sowing / transplantation, manuring and fertilization, irrigation, intercultural operation). 8.4 . the insect, Pests, Diseases and physiological disorder and its management. **8.5** . the harvesting (Stage of maturity, method of harvesting), yield, grading, packaging, transports, storage and Marketing .	
• To import the knowledge of improved culture practices of cucurbitaceous crops • To import the knowledge of management practices of cultivated filed. • To import the knowledge of postharvest practices of cucurbitaces crops.	**Unit 9:** **Cultivation practices of Cucurbitaceous (Bitter gourd, bottle gourd, cucumber , muskmelon , watermelon , pointed gourd , pumpkin , squash)** 8.1 Introduction, Composition and uses, Origin and distribution. 8.2 . the Species and Cultivars, Soil and climate, Area and production, Nursery bed preparation. 8.3 . the Cultivation practices (Sowing / transplantation, manuring and fertilization, irrigation, intercultural operation). 8.4 . the insect, Pests, Diseases and physiological disorder and its management. **8.5** . the harvesting (Stage of maturity, method of harvesting), yield, grading, packaging, transports, storage and Marketing .	**4**
• To import the knowledge of improved culture practices of perennial crops • To import the knowledge of management practices of cultivated filed. • To import the knowledge of postharvest practices of perennial crops.	**Unit 10:** **Cultivation practices of Perennial crops (asparagus)** 10.1 Introduction, Composition and uses, Origin and distribution. 10.2 . the Species and Cultivars, Soil and climate, Area and production, Nursery bed preparation.	**3**

	10.3 . the Cultivation practices (Sowing / transplantation, manuring and fertilization, irrigation, intercultural operation). 10.4 . the insect, Pests, Diseases and physiological disorder and its management. **10.5** . the harvesting (Stage of maturity, method of harvesting), yield, grading, packaging, transports, storage and Marketing .	
• To import the knowledge of improved culture practices of **Spices** crops • To import the knowledge of management practices of cultivated filed. • To import the knowledge of postharvest practices of **Spices** crops.	**Unit 11:** **Cultivation Practices of Spices (ginger , coriander , cumin, cardamom , turmeric)** 11.1 Introduction, Composition and uses, Origin and distribution. 11.2 . the Species and Cultivars, Soil and climate, Area and production, Nursery bed preparation. 11.3 . the Cultivation practices (Sowing / transplantation, manuring and fertilization, irrigation, intercultural operation). 11.4 . the insect, Pests, Diseases and physiological disorder and its management. **11.5** . the harvesting (Stage of maturity, method of harvesting), yield, grading, packaging, transports, storage and Marketing.	**3**

IV. Course Contents Practical

	Commercial vegetable production and marketing	**59 hours**
1	Study of different feature of an vegetable farming	1
2	Tools and implements used in horticulture	1
3	Nursery bed preparation and raising of different vegetable crops	3
4	Varietal characteristics and identification of major vegetable	3
3	Field preparation for vegetable crops	6
4	Method of sowing and transplantation of vegetable crops	6
5	Method of irrigation of vegetable farming	3
6	Intercultural operation (thinning , gap filling , weeding , mulching , earthing up staking) of vegetable	4
7	Training and pruning of different vegetable	4
8	Weeds and their management in vegetable crops	4

9	Manuring and fertilization of vegetable crops	4
10	Identification and management of nutritional deficiencies in vegetable crops	3
11	Judgment of harvest maturity in vegetable crops	3
12	Grading , packaging and storage of vegetable crops	4
13	Marketing system of vegetable	4
14	Processing of vegetable	4
15	Visit of commercial vegetable farm	1
16	Visit of vegetable market	1

V. INSTRUCTIONAL MATERIALS:

- To be guided by Teaching Manual

VI. INSTRUCTIONAL TECHNIQUES:

- To be guided by Teaching Manual

VII. MARKS AND HOURS DISTRIBUTION (all units should have equal marks)

- To be guided by Teaching Manual

VIII. EVALUATION SCHEMES

c. Theory Evaluation:

S. No.	Topics	No. of Questions	Marks	Total
1	Very Short Questions	5	1	**5**
2	Short Questions	5	4	**20**
3	Long Question (Analytical)	1	5	**5**
	Total			**30**

d. Practical Evaluation:

Internal Evaluation Marks	External Evaluation Marks
25	20

Lab Exercises are guided by marks distribution and Teaching Manual.

Practical Internal Examination Evaluation Scheme (25 Marks)

Internal evaluation will be conducted by course teacher based on following activities:

1. Attendance and Class Performance	2 Marks
2. Lab/Field/Case Study Report	3 Marks
3. Practical First Exam	10 Marks
4. Practical Second Exam	10 Marks
Total	25 Marks

Practical External Examination Evaluation Scheme (20 Marks)

1. Practical Exam	15 Marks
2. Viva voce	5 Marks
Total	20 Marks

IX. REFERENCES BOOKS

Singh, K.P. and R.R. Bhandari .2015 Vegetable crops production Technology. Samiksha Publication, Kathmandu , Nepal .

श्रेष्ठ , ज्ञानकुमार ।२०६८। तरकारी उत्पादन प्रविधि, डेरिटेज पब्लिशर्स एण्ड डिष्ट्रिब्युटर्स प्रालि काठमाण्डौ,

Arya, P.R. and Sant Prakash .2002. Vegetable growing in India. Kalyani Publication, India .

Thompson ,H.C and Williom C. K. 1978. Vegetable Crops . Tata McGRAW-Hill Publishing company Ltd. New Delhi.

Bishwajit Choudhary .2000. Vegetables . National Book Trust. India

Commercial Mushroom Production and Marketing

Full Marks: 50 (20T + 30P)
Pass Marks: 7T + 12P
Periods per week: 2T + 2P
Teaching Hours: 48 [Theory (T) 20 + Practical (P) 28]

I. INTRODUCTION

Course Description: This course consists of knowledge and skills related to commercial mushroom production and marketing. It gives detail knowledge of appropriate cultivation practices of commercial mushroom production and marketing in Nepal.

Theory

Important and scope of mushroom in Nepal. Advantage of mushroom cultivation . Potentiality of mushroom production in relation to local as well as international markets Classification of mushroom. Important cultivation and wild mushroom of Nepal. Characteristics and identification of edible and poisons mushroom. Types of mushroom. Cultivation practices, diseases, pest and their management and economical aspects of Button mushroom, Paddy straw mushroom, oyster mushroom, Shiitake mushroom , gyanodarma mushroom .

Practical

Cultivation practices of Button mushroom: Selection and preparation of strains , Spawn production .Method of Compost preparation .Beds preparation for mushroom cultivation .Spawning method. Casing method. Handling the crop. Harvesting method. Grading , packaging and storage. Marketing of mushroom. Processing of mushroom. Cultivation practices of paddy straw mushroom: Spawn production. Substrate selection. Growing. Cultivation methods. Method of harvesting. Grading , packaging , storage of mushroom Marketing of mushroom. Processing the mushroom. Cultivation practices of Oyster mushroom: Spawn production. Substrate selection. Selection of growing site. Spawning. Filling. Handling of crop. Harvesting methods. Grading , packaging , storage and marketing. Processing. Cultivation practices of Gyanodarma and shiitake mushroom: Spawn production . Substrate selection and preparation Spawning. Handling of crop. Harvesting methods. Grading , packaging , storage and marketing. Processing. Diseases and pest of mushroom and their management

II. OBJECTIVES:

- To know the importance and scope of mushroom production and marketing.
- To classify the mushroom and its management.
- To know the concept of cultivation practices of commercial mushroom production.

III. COURSE CONTENTS BREAKDOWN THEORY

Unit	**Commercial mushroom production and marketing**	**20 hour**

• To know about the important and scope of mushroom production in Nepal. • To know about the potentiality and advantage of commercial mushroom production .	**Unit 1:** **Introduction** 1.1 Importance and scope 1.2 advantage of mushroom cultivation 1.3 Potentiality of mushroom production in relation to local as well as international markets 1.4 Classification of mushroom 1.5Important cultivation and wild mushroom of Nepal 1.6 Characteristics and identification of edible and poisons mushroom 1.7 Type of mushroom	**2**
• To import the knowledge of commercial cultivation practices of button mushroom. • To import the knowledge of management practices of button mushroom cultivated filed. • To import the knowledge of postharvest practices of button mushroom .	**Un it 2:** **Cultivation practices of Button mushroom** 2.1 Selection of strains 2.2 Maintenance of strains 2.3 Spawn and spawn production 2.4 Compost preparation 2.5 Preparation beds 2.6 Spawning method 2.7 Casing method 2.8 Handling the crop 2.9 Harvesting method 2.10 Grading , packaging and storage 2.11 Marketing of mushroom 2.12 Processing of mushroom	**4**
• To import the knowledge of commercial cultivation practices of mushroom. • To import the knowledge of management practices of mushroom cultivated filed. • To import the knowledge of postharvest practices of mushroom .	**Unit 3:** **Cultivation practices of paddy straw mushroom** 3.1 Spawn production 3.2 Substrate selection 3.3 Time of growing 3.4 Cultivation methods 3.5 Method of harvesting 3.6 Grading , packaging , storage of mushroom 3.7 Marketing of mushroom 3.8 Processing the mushroom	**4 hour**

• To import the knowledge of commercial cultivation practices of oyster mushroom. • To import the knowledge of management practices of oyster mushroom cultivated filed. • To import the knowledge of postharvest practices of oyster mushroom .	**Unit 4:** **Cultivation practices of Oyster mushroom** 4.1 Spawn production 4.2 Substrate selection 4.3 Selection og growing site 4.4 Spawning 4.5 Filling 4.6 Handling of crop 4.7 Harvesting methods 4.8 Grading , packaging , storage and marketing 4.9 Processing	**4**
• To import the knowledge of commercial cultivation practices of Gyanodarma and shiitake mushroom. • To import the knowledge of management practices of Gyanodarma and shiitake mushroom cultivated filed. • To import the knowledge of postharvest practices of Gyanodarma and shiitake mushroom.	**Unit 5:** **Cultivation practices of Gyanodarma and shiitake mushroom** 5.1 Spawn production 5.2 Substrate selection 5.3 Selection og growing site 5.4 Spawning 5.5 Filling 5.6 Handling of crop 5.7 Harvesting methods 5.8 Grading , packaging , storage and marketing 5.9 Processing	**4**
• To import the knowledge of diseases and pest of mushroom • To import the knowledge of diseases and pest management of mushroom.	**Unit 6:** **Diseases and pest of mushroom and their management** 6.1 Fungal diseases 6.2 Non-pathogenic diseases 6.3 Bacterial diseases 6.4 Viral diseases 6.5Insect pest 6.6 Nematodes	**2**

IV. Course Content Practical

S.N	**Commercial mushroom production and marketing**	**28 hours**
A	**Cultivation practices of Button mushroom**	**6**
1	Selection and preparation of strains	
2	Spawn production	
3	Method of Compost preparation	

4	Beds preparation for mushroom cultivation	
5	Spawning method	
6	Casing method	
7	Handling the crop	
8	Harvesting method	
9	Grading , packaging and storage	
10	Marketing of mushroom	
11	Processing of mushroom	
B	**Cultivation practices of paddy straw mushroom**	**6**
12	Spawn production	
13	Substrate selection	
14	Growing	
15	Cultivation methods	
16	Method of harvesting	
17	Grading , packaging , storage of mushroom	
18	Marketing of mushroom	
19	Processing the mushroom	
C	**Cultivation practices of Oyster mushroom**	**6**
20	Spawn production	
21	Substrate selection	
22	Selection of growing site	
23	Spawning	
24	Filling	
25	Handling of crop	
26	Harvesting methods	
27	Grading , packaging , storage and marketing	
28	Processing	
D	**Cultivation practices of Gyanodarma and shiitake mushroom**	**6**
29	Spawn production	
30	Substrate selection and preparation	
31	Spawning	
32	Handling of crop	
33	Harvesting methods	
34	Grading , packaging , storage and marketing	
35	Processing	
E	**Diseases and pest of mushroom and their management**	**4**

V. INSTRUCTIONAL MATERIALS:

- To be guided by Teaching Manual

VI. INSTRUCTIONAL TECHNIQUES:

- To be guided by Teaching Manual

VII. MARKS AND HOURS DISTRIBUTION (all units should have equal marks)

- To be guided by Teaching Manual

VIII. EVALUATION SCHEMES

a. Theory Evaluation:

S. No.	Topics	No. of Questions	Marks	Total
1	Very Short Questions	5	1	**5**
2	Short Questions	5	2	**10**
3	Long Question (Analytical)	1	5	**5**
	Total			**20**

b. Practical Evaluation:

Internal Evaluation Marks	External Evaluation Marks
15	15

Lab Exercises are guided by marks distribution and Teaching Manual.

Practical Internal Examination Evaluation Scheme (15 Marks)

Internal evaluation will be conducted by course teacher based on following activities:

1. Attendance and Class Performance	2 Marks
2. Lab/Field/Case Study Report	3 Marks
3. Practical First Exam	10 Marks
Total	15 Marks

Practical External Examination Evaluation Scheme (20 Marks)

1. Practical Exam	10 Marks
2. Viva voce	5 Marks
Total	15 Marks

IX. REFE RENCES BOOKS

Kapoor, J.N.1999.Mushroom Cultivation. Publication and information division, Indian council of Agricultural Research, Pusa , New Delhi , India .

पन्त, सुमन । २०७० । व्यावसायिक च्याउ खेति । पांचपोखरी प्रकाशन गृह , न्युरोड, काठमाण्डौ, नेपाल ।

न्यौपाने, संकर प्रसाद। २०६८ । नेपालमा च्याउ खेति । हिसी प्रिन्टीङ्ग प्रेस ।

Sustainable Integrated Nutrient and Pest Management (SINPM)

Full Marks: 75 (30T + 45P)
Pass Marks: 11T + 18P
Periods per week: 2T + 2P
Teaching Hours: 96 [Theory (T) 37 + Practical (P) 59]

I. INTRODUCTION

Course description: This course includes basic knowledge and skills on sustainable integrated plant nutrient management and integrated pest management for sustainable and environment friendly farming.

Theory (37 Hrs)

Introduction, importance and concept of integrate pest and nutrient management approach . Overview of the IPM and INM approach in Nepal. Overview of pest management and IPM in Nepal . Method of IPM approach. Physical, Mechanical Cultural and biological method of pest management . Host plant resistance and botanical methods of pest management. Organic pest management method .Biotechnological method of pest management. Hormones , Pheromones. Dissemination of IPM approach through FFS. Pesticide and their management . Pesticide residue levels, tolerance limits. Safe use of chemical pesticides. General principle of plant diseases management. Plant diseases management through cultural and chemical methods. Host plant resistance in diseases management preparation and application methods of bio-pesticides, botanical and organic pesticides.

Farm yard manures (FYM) improvement, urine collection and utilization . Importance and type of organic manures. Preparation methods and utilization of organic manures (e.g. vermicompost, compost etc), green manure. Importance , type and utilization of bio-fertilizers.

Practical (59 Hrs)

Development the IPM model for important insect and diseases of major crops and their used in field . Identification of natural enemies, parasites, predators and their use cultural and multiplication. Collection, preparation and use of locally available botanicals pesticides. Development the integrated nutrient management models for major crops . Identification of organic manures and fertilizers. Preparation and use of organic manures (e.g. vermi-compost , compost etc), FYM improvement and use. Urine collection, improvement and use.

II. **OBJECTIVES**:

On completion of this course, students will be able:

- To conceptualize and practice integrated plant nutrients management in major field crops and vegetable crops grown in Nepal
- To conceptualize and practice integrated pest management in major field crops and vegetable crops grown in Nepal

III. COURSE CONTENTS BREAKDOWN THEORY

Specific Objective	Contents	Contact Hours (37)
• To import the knowledge of importance and scope of IPNM • To import the knowledge of effect and impact of chemical fertilizer and pesticide on soil, health and environment	**Unit 1:** **Introduction** 1.1. Definition, importance and scope of integrated plant nutrient management 1.2. Definitions and approaches of sustainable agriculture and organic agriculture 1.3. Effect and impact of chemical fertilizers on soil structure, soil fertility and environment 1.4. Definition, importance and scope of integrated pest management 1.5. Definition and concept of biological methods of pest management 1.6. Effect and impact of chemical pesticides on health and environment	**5**
• To import the knowledge of integrated plant nutrient management approach	**Unit 2.** **Integrated plant nutrient management** 2.1. Definitions, concepts and approaches of Ecosystem, Agro-ecosystem, Agro-ecology 2.2. Revitalization of soil 2.3. Land degradations and its preventive measures 2.4. Organic recycling,	**5**
• To import the knowledge of manures and fertilizers preparation methods	**Unit 3.** **Types and methods of preparation of manures and fertilizers** 3.1 Types of bio-fertilizers, Rhizobium culture, Mycorrhiza culture 3.2 Types of organic manures 3.3 Methods of preparing and using bio-fertilizers 3.4 Organic manures and farm yard manure 3.5 Green manuring and mulching	**5**
• To import the knowledge of cropping system .	**Unit 4.** **Cropping systems** 4.1. Scientific crop rotation	**5**

	4.2. Rotational intensity 4.3. Cropping patterns and cropping intensity 4.4. Inter / mixed cropping systems 4.5. Bio-intensive farming system 4.6. Permaculture system	
• To import the knowledge of farmers field school approach	**Unit 5.** **Farmer's Field School** 5.1. Concept, and approach of Farmer Field School 5.2. Steps and processes of IPNM-FFS	**5**
• To import the knowledge of integrated pest management approach and FFS	**Unit 6** **Integrated Pest Management and FFS** 3.1 Useful insect pests prevalent in various ecological conditions 3.2 Mechanical, cultural biological and chemical methods of pest management in Nepal 3.3 Concept, principles and methods of IPM 3.4 Host plant resistance and botanical methods of pest management. 3.5 Organic pest management method. 3.6 Biotechnological method of pest management. 3.7 Hormones, Pheromones, Sterile insect technique methods	**3**
• To import the knowledge of Safety and pollution issues	**Unit 7.** **Safety and pollution issues** 7.1. Safe use of pesticides 7.2. Pesticide Rules and regulations in Nepal 7.3. Prevention of pollution caused by chemical pesticides 7.4. Plant diseases management through cultural and chemical methods. Host plant resistance in diseases management	**4**
• To import the knowledge of Bio-pesticides, organic pesticides and efficiency**.**	**Unit 8.** **Bio-pesticides, organic pesticides and efficiency** 8.1. Preparation and application methods of bio-pesticides, and organic pesticides. 8.2. Preparation and application methods of	**3**

	botanical pesticides including *"Geeeti mal"* 8.3. Efficiency of biological and botanical pesticides including *"Geeeti mal*	
• To import the knowledge of IPM Farmer's Field Schools **.**	**Unit 9.** **IPM Farmer's Field Schools** 9.1. Step and processes of IPM FFS 9.2 Role of farmer's groups in sustainability of FFS	**2**

IV. Course Contents of Practical

Practical	Contact Hours (**59)**
1. Development of the IPM model for important insect pests of selected crops (cereal: rice, maize, wheat, vegetables: cucurbitaceous vegetables, cruciferous vegetables, tuber: potato, legumes: soybean, black/green gram, chickpea, beans) and their use in field .	10
2. Development of the IPM model for important diseases of selected crops (cereal: rice, maize, wheat, vegetables: cucurbitaceous vegetables, cruciferous vegetables, tuber: potato, legumes: soybean, black/green gram, chickpea, beans) and their use in field .	10
3. Identification of natural enemies, parasites, predators and their use .	6
4. Collection, preparation and use of locally available botanicals for making pesticides .	5
5. Development of the integrated nutrient management models for major crops.	5
6. Identification of organic manures and fertilizers.	6
7. Preparation and use of organic manures (e.g. vermi-compost, compost, *geeti mal* etc)	5
8. FYM improvement and use	6
9. Cattle urine collection, improvement and use.	6

V. INSTRUCTIONAL MATERIALS:

- To be guided by Teaching Manual

VI. INSTRUCTIONAL TECHNIQUES:

- To be guided by Teaching Manual

VII. MARKS AND HOURS DISTRIBUTION (all units should have equal marks)

- To be guided by Teaching Manual

VIII. EVALUATION SCHEMES

e. Theory Evaluation:

S. No.	Topics	No. of Questions	Marks	Total
1	Very Short Questions	5	1	**5**
2	Short Questions	5	4	**20**
3	Long Question (Analytical)	1	5	**5**
	Total			**30**

f. Practical Evaluation:

Internal Evaluation Marks	External Evaluation Marks
25	20

Lab Exercises are guided by marks distribution and Teaching Manual.

Practical Internal Examination Evaluation Scheme (25 Marks)

Internal evaluation will be conducted by course teacher based on following activities:

1. Attendance and Class Performance	2 Marks
2. Lab/Field/Case Study Report	3 Marks
3. Practical First Exam	10 Marks
4. Practical Second Exam	10 Marks
Total	25 Marks

Practical External Examination Evaluation Scheme (20 Marks)

1. Practical Exam	15 Marks
2. Viva voce	5 Marks

Total	20 Marks

IX. REFERENCES BOOKS

1. Neupane, F.P. 2058. *Balibiruwaka satruharu ra tinko roktham,* 4th ed. Sajha Prakashan, Kathmandu, Nepal
2. Rajbhandari, B.P. 2010. Grain legumes of Nepal, HICAST
3. Rajbhandari, B.P. 2008. Model demonstration farm and farmer's field school management: a manual, WOREC.
4. Rajbhandari, B.P. 2008. Bio-intensive farming system, Kathmandu, WOREC.
5. Plant Protection Directorate.2068. IPM an introduction (in Nepali). MOAC, Kathmandu
6. SSMP and STSD. 2002. Integrated plant nutrient management. Sustainable Soil Management Project and Soil Testing and Service Division, Kathmandu.