

COURSES OF STUDIES
OF
BACHELOR OF SCIENCE (Honors) IN AGRICULTURE

PURBANCHAL UNIVERSITY
FACULTY OF SCIENCE AND TECHNOLOGY

Gothagaun

Revision 2021

CURRICULUM ON

BACHELOR OF SCIENCE (HONOURS) IN AGRICULTURE

Introduction

Purbanchal University is offering four year Bachelor of Science (Hon) in Agriculture through its constituent and affiliated colleges to address the national needs of high-level technical manpower in agriculture. The curricula give emphasis on field based internship, laboratory works and theories to develop adequate knowledge, skill and confidence in students to undertake agriculture and rural development activities, and entrepreneurship for self-employment.

The students will have to undergo field-based internship in the last semester. Such internship arrangements are made in various government organizations, agro-based industries, research farms as well as private farms and NGOs operating in various agro-ecological conditions. The students are required to produce report of field research/case study in thesis format during internship. Field-based internship is meant for broadening the vision, horizon of understanding and develop confidence in the student as well as imparting practical knowledge in relation to his/her field of research.

Curriculum Design

The curriculum includes basic, core and applied courses. The curriculum development is a continuous process which is reviewed and upgraded periodically to incorporate new information generated from research or/and practices to address the changing needs of farming communities and agro-industries of the country. It includes theory and practical exercises required by each disciplines or subject matters. The vertical and horizontal placement of the courses in the semesters and the course content are reviewed and discussed critically among the experts and faculty of related discipline.

The course code listed have three letter text with three digits. The first digit of the numbers indicates the year in which the course is offered, the second digit indicates the semester of a year in which the course it offered and third digit indicates the serial number of the courses of a discipline/subject matter.

Curriculum Delivery System:

Courses are designed and delivered in semester system with 162 credit hours. One semester consists of 15 working weeks for classroom and practical exercises. Semester examination and extra- curricular activities like sport events have additional weeks. Each and every course is assigned with credit ranging from 1 to 3 hour. The course with credit hour of 2+1 has two theory classes and one practical class in a week. The theory class is of one hour and practical class is of 2 hours.

Objectives of the curricula:

To develop globally competent and skilled human capital with new vision of environment friendly modern agriculture and rural development,

To develop motivation, confidence, enthusiasm and skill in the graduates for entrepreneurship,

To develop knowledge, skill and experiential learning in graduates who can address current and emerging technical problems of farming communities and agro-industries of the country,

To motivate the graduates to serve as development agents to the farming communities and agro industries in rural and remote region of the country,

To widen the horizon of technical knowledge in graduates for additional job opportunities in public and private sectors, and

To prepare carrier path for postgraduate studies leading to MS/PhD

TEACHING MEDIUM

The medium of instruction of B. Sc. (Honors) Agriculture is English, and all the tests and examinations are conducted in English.

ACADEMIC CALENDAR AND EXAMINATION

The program is run in semester system. The new academic session starts in 1st September. The students will have to undergo one internal assessment in each semester before appearing in the final semester examination. Internal assessment would also include various types of assignments.

ELIGIBILITY FOR ADMISSION

Students having at least 45 percent (second division) overall score in 0+2 (science) or equivalent grade are eligible to apply for admission to the bachelor's program. Enrolment will be based on the marks secured in the entrance examination conducted by the university.

TEACHING METHODS

The teaching methods applied are lecture, laboratory exercises, field works, group discussion, course work or work project. Practical classes in form of laboratory works are used to verify the concept and develop required technical and analytical skills. Similarly, course works and course projects are aimed at creating necessary knowledge and skill to implement and present the acquired technical and analytical skills in the form of projects.

EVALUATION AND GRADING SYSTEM

The evaluation of the student's knowledge is done through internal assessments during the course works and followed by final semester examination. For the theoretical components of a subject, 20% of total marks is allocated for the internal assessment and 80% for the final semester examination, while for practical component, the method of continuous assessment is adopted except for limited particular subjects in which semester examination are also conducted.

The student must obtain at least 40% mark in internal assessment in each subject to be eligible to sit in the final semester examination. The student should get 40% mark to pass in semester examination. The students who have passed all the subjects in all semester are considered to have successfully completed the course.

Depending upon the final aggregate percentage score, 4 passing grades A, B, C, and D and one failing grading F are used. The letter grades used to show the academic standing of a student, with the following meaning and grade points i.e. weights are as follow:

Letter Grade Equivalent Marks Meaning

| | |
|---|----------|
| A | 80-100 |
| B | 60-79 |
| C | 50-59 |
| D | 40-49 |
| F | Below 40 |

Distribution of Courses by Semester

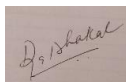
YEAR I

Semester I

| Course Code | Title of Course | Credit |
|-------------|------------------------------|----------|
| PPH 110 | Plant Physiology | 2+1 |
| HRT 111 | Principles of Horticulture | 2+1 |
| SOS 111 | Fundamentals of Soil Science | 2+1 |
| AGR 111 | Principles of Agronomy | 2+1 |
| ANS 111 | Introductory Animal Science | 2+1 |
| EXT 111 | Rural Sociology | 2+1 |
| ECN 111 | Principles of Economics | 3+0 |
| PHE 110 | Yoga | 0+1 |
| | Total | 15+7= 22 |

Semester II

| Course Code | Title of Course | Credit |
|-------------|--|----------|
| BCH 120 | General Biochemistry | 2+1 |
| SOS 122 | Soil Fertility, Fertilizers and Integrated Nutrient Management | 2+1 |
| PLP 121 | Introductory Plant Pathology | 2+1 |
| MIB 120 | Agriculture Microbiology | 2+1 |
| ANS 122 | Ruminant Management | 1+1 |
| EXT 122 | Extension Education and Communication | 2+1 |
| ENT 121 | Principles of Entomology | 2+1 |
| HRT 122 | Ornamental Horticulture | 2+1 |
| | Total | 15+8= 23 |



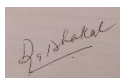
YEAR II

Semester I

| Course Code | Title of Course | Credit |
|-------------|--|---------|
| PLB 211 | Genetics | 2+1 |
| AGR 212 | Cereal Crop Production | 2+1 |
| MAP 210 | Medicinal and Aromatic Plant | 1+1 |
| PLP 212 | Crop Disease Management | 2+1 |
| ENT 212 | Crop Insect Pest Management | 2+1 |
| SOS 213 | Soil Physics, Genesis and Classification | 2+1 |
| HRT 213 | Plantation and Spice Crops Production | 1+1 |
| ANS 213 | Pig and Poultry Management | 1+1 |
| | Total | 13+8=21 |

Semester II

| Course Code | Title of Course | Credit |
|-------------|--|---------|
| AQU 220 | Aquaculture | 2+1 |
| ANS 224 | Animal Nutrition and Feeding Practices | 2+1 |
| PLB 222 | Principles and Practices of Plant Breeding | 2+1 |
| HRT 224 | Vegetable Crop Production | 2+1 |
| ECN 222 | Farm Management and Production Economics | 2+1 |
| ENR 221 | Farm Power and Machinery | 1+1 |
| AGR 223 | Grain Legumes, Oil Seed and industrial Crops | 2+1 |
| ENS 221 | Agriculture Meteorology and Climate Change | 2+0 |
| | Total | 15+7=22 |



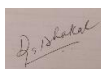
YEAR III

Semester I

| Course Code | Title of Course | Credit |
|-------------|--|---------|
| HRT 315 | Fruit Crop Production | 2+1 |
| ENR 312 | Farm Water Management | 2+1 |
| STT 310 | Agriculture Statistics | 2+1 |
| AGR 314 | Weed management | 1+1 |
| ENT 313 | Integrated Pest Management | 2+1 |
| ECN 313 | Agriculture Marketing and Cooperatives | 2+1 |
| ECN 314 | Entrepreneurship Development | 2+1 |
| PLB 313 | Plant Biotechnology and Biodiversity | 2+1 |
| | Total | 15+8=23 |

Semester II

| Course Code | Title of Course | Credit |
|-------------|--|----------|
| EXT 323 | Social Mobilization and Community Development | 2+1 |
| ECN 325 | Agribusiness Management | 2+1 |
| AGR 325 | Principles and Practices of Seed Technology | 2+1 |
| ANS 325 | Principles and Practices of Animal Breeding | 2+1 |
| SOS 324 | Soil Conservation and Watershed Management | 2+1 |
| SOS 325 | Remote Sensing and GIS in Agriculture | 1+1 |
| HRT 326 | Post-harvest Management of Horticultural Crops | 2+1 |
| PLP 323 | Plant Clinic | 0+2 |
| | Total | 13+9= 22 |



YEAR IV

Semester I

| Course Code | Title of Course | Credit |
|-------------|---|---------|
| HRT 417 | Plant Propagation and Nursery Management | 1+1 |
| HRT 418 | Agroforestry | 1+1 |
| ENT 414 | Industrial Entomology | 1+1 |
| ENS 412 | Environmental Science and Agro-ecology | 2+0 |
| ANS 416 | Introductory Dairy Technology | 2+1 |
| AGR 416 | Principles and Practices of Organic Farming | 2+1 |
| ECN 416 | Agriculture Finance | 2+0 |
| ECN 417 | Agriculture Project Planning | 1+1 |
| INT 411 | Internship I (Planning and Presentation of Project) | 0+1 |
| | Total | 12+7=19 |

Semester II

| Course Code | Title of Course | Credit |
|-------------|--|---------|
| INT 422 | Internship II (A Case Study / Field Experiment) | 0+9 |
| INT 423 | Seminar (Presentation of Research Findings) | 0+1 |
| | Total | 0+10=10 |



Courses by Semester

YEAR I

Semester I

| Course Code | Title of Course | Credit |
|-------------|------------------------------|----------|
| PPH 110 | Plant Physiology | 2+1 |
| HRT 111 | Principles of Horticulture | 2+1 |
| SOS 111 | Fundamentals of Soil Science | 2+1 |
| AGR 111 | Principles of Agronomy | 2+1 |
| ANS 111 | Introductory Animal Science | 2+1 |
| EXT 111 | Rural Sociology | 2+1 |
| ECN 111 | Principles of Economics | 3+0 |
| PHE 110 | Yoga | 0+1 |
| | Total | 15+7= 22 |



Code No: PPH 110

Course Title: Plant Physiology

Credits: 2+1

Nature of Course: Theory + Practical

Teaching Hours: 30+30

Objectives: Upon the completion of the course the students will be able to understand how plants live and function.

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction, scope and application of plant physiology in relation to agriculture; plant cell, its

organelles and tissues in relation to physiological processes- cell, cell wall, cell membrane, nucleus, vacuole, plastids, mitochondria. **2 hrs.**

Unit 2. Plant water relations: Osmosis, turgor pressure, plasmolysis, imbibition, absorption and transport of water, passive and active transport, path of water, ascent of sap, Mechanism of ascent of sap. **2hrs.**

Unit 3. Transpiration: definition and types of transpiration, factors affecting transpiration; guttation, leaf anatomy and stomata structure: mechanism of stomata opening. **2hrs.**

Unit 4. Plant and mineral nutrients: essential mineral nutrients and their roles; nitrogen cycle, biological nitrogen fixation, nitrogen deficiency symptoms. **3hrs.**

Unit 5. Photosynthesis: Introduction, significance, photosynthetic apparatus and photosynthetic pigments. Mechanism of photosynthesis: light dependent reactions, calvin cycle, photorespiration, C4 and CAM pathways. Photosynthesis: factors affecting photosynthesis, allocation of photosynthates, photosynthetic efficiency and crop production. Molecular biology and genetic engineering in photosynthesis research. **5 hrs.**

Unit 6. Respiration: Introduction, types, respiratory quotient; mechanism of respiration: glycolysis, pyruvate oxidation, citric acid cycle (Kerb's cycle), oxidative phosphorylation; respiration: factors affecting respiration, fermentation, a brief introduction to mitochondrial biology with molecular and genetic engineering approach. **5 hrs.**

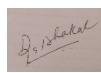
Unit 7. Plant growth and plant growth regulators (PGRs): Plant growth and cell growth, concept on growth regulator and different families of plant growth regulators. PGRs: chemical nature, biosynthesis, distribution, and role of different hormones: auxins, cytokinins, gibberellins, ethylene and abscissic acid. Senescence and abscission; new families of PGRs- salicylic acid and other emerging PGRs. **3 hrs.**

Unit 8. Photomorphogenesis: Phytochromes, chemical nature and its mechanism of action and importance in physiology; modern approaches in phytochromes and photomorphogenesis in biology and biotechnology. **2 hrs.**

Unit 9. Seed germination: Metabolic changes during seed germination, factors affecting 2hrs.

Germination; Seed and bud dormancy, factors affecting dormancy, breaking of dormancy, Abscission and Senescence. **2 hrs.**

Unit 10. Photoperiodism and vernalization; concept of allelopathy and phytoalexins; review on class activities and conclusion. **2 hrs.**



B. Practical (30 Hours)

| SN | Topic | Practical |
|-------|---|-----------|
| 1 | Study of the process of osmosis: imbibition by seeds. | 1 |
| 2 | Plasmolysis of living plant cell. | 1 |
| 3 | Structure and distribution of stomata in dicot leaves | 1 |
| 4 | Unequal transpiration in dicot leaves | 1 |
| 5 | Demonstration of ascent of sap and path of ascent of sap in plants | 1 |
| 6 | Extraction of Chlorophyll or other pigments and separation by paper chromatography | 1 |
| 7 | Photosynthesis- O ₂ evolution during photosynthesis & CO ₂ is necessary for photosynthesis | 1 |
| 8 | Starch test. Light and chlorophyll are necessary for photosynthesis | 1 |
| 9 | Study of C ₃ and C ₄ leaf anatomy. | 1 |
| 10 | Production of CO ₂ in aerobic respiration & Production of CO ₂ during anaerobic respiration. | 1 |
| 11 | PGRS and role in agriculture and physiology- Auxin and coleoptile elongation. Gibberellin stimulates stem elongation. GA ₃ stimulates stem elongation. Cytokinin delays senescence & Ethylene enhances fruit ripening. | 2 |
| 12 | Demonstration of types of germination: Hypogeal and Epigeal. | 1 |
| 13 | Field visit to study nutritional disorders | 1 |
| 14 | Regions of growth in root and stem. Measurement of growth using Ananometer. | 1 |
| Total | | 15 |

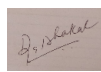
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Salisbury, F. B. and C. W. E. Ross. 1991. Plant Physiology. CBS Publication and Distributor



Corse Code HRT 111

Course Title: Principles of Horticulture

Credit 2+1

Nature of course: Theory and Practical

Teaching Hours 30+30

Objectives: Upon the completion of the course the students will develop knowledge and skill in basic principles and practices of horticultural crop production

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: definition, branches, scope and importance of horticulture, classification of horticultural crops, nutritive values, area and production, exports and imports of fruits, vegetables, flowers and other horticultural products, horticulture zone of Nepal. 2 hrs.

Unit 2. Climate in horticultural crop production: temperature, radiation, humidity, rainfall, and wind; adverse effects of climate, effect of climate change on horticulture crops. 3 hrs

Unit 3. Soil in relation to horticultural crops: soil and soil types, soil reaction and nutrient availability, and soil improvement. 2hrs

Unit 4. Establishment of horticultural enterprises: types of enterprises such as nurseries, vegetable gardening, orchards, site selection, layout, field preparation, planting and management. 3 Hrs

Unit 5. Training and pruning: objectives, principles and methods of training and pruning of fruits trees and ornamental plants, and rejuvenation of old orchards 3 Hrs

Unit 6. Flowering and fruiting: flowering fruit trees, bearing habit, unfruitfulness, regulation of flowering and fruiting 3 Hrs


Unit 7. Plant growth regulators: Definition, classes, synthesis, physiological functions and uses in fruits, vegetables and ornamental plants of auxins, giberellins, cytokinins, ethylene and inhibitors. 4 hrs.

Unit 8. Plant growth and development: seed, bud and tree dormancy, germination, growth, development, juvenility, maturity, flowering, fruit set, fruit growth, ripening and senescence. 4 hrs.

Unit 9. High-tech horticulture: high density planting- objective, relevancy, principles, methods, techniques of controlling tree geometry and volume; multistoried, hydroponic, aeroponic, bonsai; crop modeling. 3Hrs

Unit 10. Principles and practices of environmentally controlled production: setup and regulation of temperature, light, humidity, air and CO₂; heating and cooling systems, ventilation in green house, naturally ventilated greenhouses, fan and pad cooled greenhouses/poly houses for high value vegetable and flower production.

B. Practical 15 (30 Hrs)

| SN | Topics | Practical |
|----|--|---|
| 1 | Identification of fruits, vegetables and ornamental plants | 1 |
| 2 | Identification of tools and implements | 1 |
| 3 | Preparation of nursery bed for sowing vegetable seeds | 1 |
| 4 | Lay out of orchard | 1 |
| 4 | Preparation of contour line for planting trees on sloppy land by using A-Frame | 1 |
| 4 | Pit digging for planting fruit trees |  |

| | | |
|----|---|---|
| 5 | Training and pruning of fruit trees and ornamental plants | 2 |
| 6 | Preparation and use of Bordeaux paste and Bordeaux mixture | 2 |
| 7 | Calculation of fertilizer doses and application in fruit trees/vegetables | 1 |
| 8 | Preparation and application of PGR in fruit trees, vegetables and ornamental plants | 1 |
| 9 | Preparation of hot beds for vegetable seeding using cow dung and plastic tunnels | 2 |
| 10 | Visit to nearby commercial vegetables/orchards | 1 |

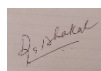
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Prasad, S, 1997. Principles of Horticulture. Agro-Botany, Bikaner, India

Shrestha G.K., Shakya S.M., Baral D.R. and Gautam D.M. 2001. Fundamentals of Horticulture (2'nd Edition). IAAS, Rampur Campus, Chitwan, Nepal



Code No: SOS 111

Course Title: Fundamentals of Soil Science

Credits: 2+1

Nature of Course: Theory + Practical

Teaching Hours: 30+30

Objectives: This course will provide knowledge of soil forming process, soil properties, concept of geology and physiographic units Nepal

Course Contents

A. Theory (30 Lectures)

Unit 1. Introduction: History of soil science, definition, concept and uses of soil; soil as a natural dynamic body 3 hrs

Unit 2. Soil plant relation: soil as medium of plant growth; solid, liquid, and gaseous components of soil as a three dimensional body. 2 hrs

Unit 3. Soil physical properties: soil texture and structure, and their importance in crop growth and development, soil color and importance in agriculture, soil bulk density, particle density, porosity, consistency, plasticity, adhesion and cohesion. 4 hrs.

Unit 4. Soil chemical properties and their management: soil pH, soil pH and nutrient availability to plants, soil acidity and factors affecting acidity, buffering capacity of soil and soil amendment to reclaim acidity, properties of saline and sodic soil, and their management; ion exchange phenomena (CEC and AEC), 5 hrs.

Unit 5. Soil biological properties: soil as a living body and biological equilibrium in the soil; soil micro-organism, their classification and their role in nutrient availability to plants. 2 hr

Unit 6. Soil organic matter (SOM): definition, SOM pool, importance, decomposition process, role of C:N ratio in SOM decomposition and effect on soil properties. 2 hr

Unit 7. Soil colloids: concept and characteristic of soil colloids, organic and inorganic soil colloids, and classification of silicate clay minerals. 2 hrs

Unit 8. Geology: evolution of earth, geological behavior elements, land forms, rock and minerals and their importance in soil; soil formation process, weathering of rocks and minerals. 4 hrs

Unit 9. Essential plant nutrients: essential elements, criteria of essential elements, forms and availability in soil, deficiency and toxicity symptoms and their management; and nutrient cycling process. 4 hrs

Unit 10. Physiographic units of Nepal: physiographic units of Nepal with dominant soil types, and major soil types of Nepal. 2 hrs

B. Practical (30 hours)

| S.N. | Topics | Practical |
|------|---|-----------|
| 1 | Identification and function of laboratory tools and equipments used in soil science practical | 1 |
| 2 | Soil and plant sampling and their preparation for laboratory analysis | 1 |
| 3 | Determination of soil solid and moisture content in different land use systems | 1 |
| 4 | Determination of soil bulk density | 1 |
| 5 | Determination of soil particle density | 1 |
| 6. | Relationship among soil bulk density, particle density and porosity | 1 |

| | | |
|--------------|---|-----------|
| 7. | Determination of soil texture by Hydrometer method | 1 |
| 8. | Determination of soil consistency by feel method | 1 |
| 9. | Use of Munsell color chart to determine soil color | 1 |
| 10. | Study on soil structure and water stable aggregates | 1 |
| 11. | Determination of soil pH of different land use systems | 1 |
| 12. | Calculation of lime requirements to reclaim soil acidity | 1 |
| 13. | Identification of major soil forming rocks | 1 |
| 14. | Identification of major soil minerals | 1 |
| 15 | Determination of electrical conductivity of different soils | 1 |
| Total | | 15 |

References

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
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Logsdon S., D. Clay, D. Moore and T. Tsegaye. 2008. *Soil Science: Step-by-Step Field Analysis*. Soil Science Society of America, Inc.



Code No: AGR 111

Course Title: Principles of Agronomy

Credits: 2+1

Nature of Course: Theory + Practical

Teaching Hours: 30+30

Objectives: Upon the completion of the course the students will be able to explain the basic concepts and principles of agronomy for the successful crop production.

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: definition of agriculture and agronomy, the scope of agronomy and role of an agronomist in solving the food problems; food security, reasons of food insecurity in Nepal, problems of Nepalese agriculture; subsistence and commercial agriculture, Green Revolution and its role in solving food problems; classification of crops: classification based on use and usable parts (agronomic), growing seasons, and special purpose. 4hrs.

Unit 2. Weather and climate in relation to crop production: definition of weather, climate, microclimate, meteorology, and agro-meteorology, solar radiation and temperature, precipitation, relative humidity, wind and their effect on crop growth, monsoon and its role in Nepalese agriculture, climate change and its impact on Nepalese agriculture. 3hrs.

Unit 3. Physiological principles of crop production: photosynthesis and factors affecting photosynthesis, differences among C₃, C₄ and CAM crops; respiration: growth and maintenance respiration, photorespiration, transpiration, evapotranspiration, plant- water relationship, source- sink relationship and their impact on drymatter production. 3 hrs

Unit 4. Crop growth and Yield: definition of crop growth, growth response curve with time, phases of crop growth. factors affecting crop growth; definition of yield, economic and biological yield, harvest index, potential yield, attainable yield, actual yield, and National average yield, yield gap analysis and closing the yield gaps. 3 hrs

Unit 5. Tillage in crop production: Definition, history, and objectives of tillage and characteristics of good soil tillage, types and methods of tillage: primary, secondary and inter-tillage, tillage implements used for tillage operation, conventional and conservation tillage with their advantages and disadvantages. 3hrs.

Unit 6. Cropping system: definition of monoculture, poly-culture, cropping pattern, cropping system, farming system, multiple cropping, sequence cropping, intercropping, mixed cropping, relay cropping, catch cropping, cover cropping, multistoried cropping. Requirements of multiple cropping, advantages of multiple cropping, calculation of cropping index, cropping intensity, land equivalent ratio and crop equivalent yield; definition, principles and advantages of crop rotation. 3 hrs

Unit 7. Soil fertility management: soil fertility and soil productivity, criteria of essentiality of elements, classification of essential elements, and forms of elements used by crops; manures: importance, classification, and characteristics of organic manures including green manures. Fertilizers: types and characteristics of chemical and biofertilizers used in crop production Factors affecting fertilizer use, time and methods of fertilizer applications. 4 hrs.

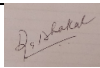
Unit 8. Irrigation and drainage: definition, and objectives of irrigation, role of water and water critical stage approach. Importance and types of drainage in crop requirement of crops.. Methods of irrigation: surface,

subsurface, sprinkler and drip irrigation, irrigation scheduling: Soil moisture depletion approach, IW/CPE approach and critical stage approach. Importance and types of agricultural drainage. 3 hrs

Unit 9. Farming systems: mix farming, cereal-based farming system, vegetable-based farming system, livestock based farming system, agro forestry farming system, bio intensive farming, problems of modern agriculture, organic farming systems, rain-fed farming system and water harvesting techniques, precision agriculture, concepts of sustainable agriculture and ecological agriculture. 2 hrs

Unit 10. Harvesting and storage system: Crops maturity indicators, harvesting techniques, yield and yield attributing characters, drying and processing of different crops; storage structures and mechanisms. 2hrs

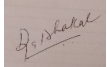
B. Practical (30 Hrs)

| S.N. | Topic | Practical |
|------|--|--|
| 1. | Seed collection of field crops and preparation of seed catalog. | 1 |
| 2. | Seed purity and germination test in laboratory | 1 |
| 3. | Calculation of seed rate based on germination, purity and real value of seed. | 1 |
| 4. | Identification and nutrient contents of common manures and fertilizers used in Nepal | 1 |
| 5. | Calculation of manures and fertilizers | 2 |
| 6. | Practices on application of manures and fertilizers in field crops | 1 |
| 7. | Preparation of improved compost to conserve nutrient | 1 |
| 8. | Identification of common weeds of field crops | 1 |
| 9. | Weed collection and preparation weed herbarium | 1 |
| 10. | Identification of herbicides and herbicide formulation, and calculation | 1 |
| 11. | Study of the cropping system of nearby farmers and calculation of cropping intensity, cropping index, and land equivalent ratio. | 1 |
| 12. | Visit to research station, agronomy farm to study the agronomic activities nearby college. | 1 |
| 13. | Field preparation and planting of seasonal crops | 1 |
| 14. | Yield attributes and yield estimation of seasonal field crops |  1 |

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2. Acquaah, G. 2011. Principles of Crop Production- Theory, Techniques and Technology, 2nd ed. Langston University, PHI Learning Pvt. Ltd. New Delhi-110001.

3. K.P. Sharma, K.R. Dahal and K.R. Neupane.1991. An Introduction to Agronomy. Published by Institute of Agriculture and Animal Science (IAAS), Rampur, Chitwan, Nepal.
4. R.M. Lantican.2001. The Science and Practices of Crop Production. University of the Philippines at Los Banos. SEAMEO SEARCA Publication
5. S. R. Reddy. 2007. Principles of Agronomy. Third Revised Edition. Kalyani Publishers. Ludhiana..
6. Reddy, T.Y. and G. H. S. Reddi . 2002. Principles of agronomy. Kalyani Publishers, Ludhiana, India.
7. ICAR. 2012. Handbook of agriculture. Indian Council of Agril. Research, New Delhi.
8. Reddy, S.R. 2011. Principles of agronomy. Kalyani Publishers, Ludhiana, India. 9.
9. Singh, S.R. 2004. Principles and practices of agronomy. Kalyani Publishers, Ludhiana, India.



Corse Code **ANS 111**

Course Title: Introductory Animal Science

Credit 2+1

Nature of Course: Theory and Practical

Teaching Hours 30+30

Objectives: Upon the completion of the course the students will gain basic knowledge of different livestock species and their breeds, and develop skill on handling of farm animals.

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: Terminologies used in animal husbandry, different livestock species and their population in Nepal, importance and scope of livestock farming in Nepal. 3 hrs

Unit 2. Phylogeny of different species of livestock, breeds and breed characteristics of different species of livestock and poultry. 4 hrs

Unit 3. Digestive and reproductive system of ruminants and non-ruminants 4 hrs

Unit 4. Routine farm operations of livestock and poultry, handling of animals and birds. 6 hrs

Unit 5 Disposal of animal and poultry waste and their management. 4 hrs

Unit 6. Principles of judging different farm animals for production and works. 3hrs

Unit 7. Animal behavior. 3 hrs

Unit 8. Record keeping in livestock farm. 3 hrs

Practical 30 Hours

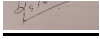
| SN | Topics | Practical |
|----|--|-----------|
| 1 | Study of different housing systems of livestock species. | 2 |
| 2 | Study of different housing systems of poultry | 2 |
| 3 | Judging of dairy cattle and buffalo. | 2 |
| 4 | Judging of swine and poultry birds | 2 |
| 5 | Shearing of sheep | 1 |
| 6 | Wool sorting and grading. | 1 |
| 7 | Grading of eggs | 1 |
| 8 | Study of poultry farm equipment and accessories | 2 |
| 9 | Visit to poultry farm | 1 |
| 10 | Visit to livestock farm. | 1 |
| | Total | 15 |

References:

Banerjee, G. C. 2006. A text book of Animal Husbandry. Oxford and IBH Publishing, New Delhi

Sastry, N. S. R. and C. K. Thomas. 2005. Livestock Production Management. Kalyani Publisher, India

Thomas, C. K. and N. S. R. Sastry. 1991. Dairy Bovine Production. Kalyani Publisher, India



Code No: EXT 111

Course Title: Rural Sociology

Credits: 2+1

Nature of Course: Theory + Practical

Teaching Hours: 30+30

Objectives: To acquaint students with basic concepts, theories and methods of rural sociology and enable them to apply the concept and the theories in analyzing the rural sociological development process in Nepal.

Course Content

A. Theory (30 Hrs)

Unit 1. Introduction: (i) Rural sociology: meaning, nature and importance. (ii) Relation of rural sociology with other science, and social science. (iii) Major scope and fields of rural sociology, methods and tools of rural sociology. (iv) Sociology and way of life. 5 Hrs

Unit 2. Rural society and social structure: (i) Concept of rural society, meaning, types of society, nature. (ii) Family, marriage, kinship, community, state, nation. (iii) Traditions, norms, values, rule, laws, practices, and modification. (iv) Rural community and its features, Nepali rural community and its global context. (v) The rural social system, social process, rural hierarchy, caste, ethnicity, family, power, structure and economy. 5 Hrs

Unit 3. An overview of social, economic, and cultural structure of Nepal: (i) Nepali society as diversity of society, caste, religion, and culture. (ii) Diversity of economic sources; agriculture, animal husbandry, labour, industry, cottage industry, trade and commerce, patterns and problems in economy, ways of solutions. 5 Hrs

Unit 4. Land system, policy and practice: (i) Kipat, Raikar, Guthi, Birta, Land reform of Nepal – 2021, 2056 BS. (ii) Land use in mountain, hill and plain area of Nepal. (iii) Land care, maintain and promotion of soil quality. 4 Hrs

Unit 5. Rural organization, leadership development and society development: (i) Concept and basic elements of rural society organization. (ii) Organization building process and development. (iii) Induced and indigenous organization. (iv) Civil Society Organization (CSO), role of CSO in social reformation. (v) Leaders and leadership building in rural social development, good leader and model society. 5 Hrs

Unit 6. Conflict and mediation trend in society: Conflict and contradiction in rural society, different ways of solution, models mediation, agreement, arbitration. 3 Hrs


Unit 7. Current discourses on rural sociology: (i) Civil society and people participation in development. (ii) Social inequality, causes and disadvantage. (iii) Policy of social inclusion in Nepal. 3 Hrs

B. Practical exercise (30 Hrs)

| SN | Exercise | Practical |
|----|---|-----------|
| 1 | Visit to rural community and identify major social problem. | 2 |
| 2 | Technique of data collection. | 2 |
| 3 | Data analysis | 2 |
| 4 | Rural need assessment of farmers of a village (PRA/RRA) | 5 |
| 5 | Report writing | 2 |
| 6 | Presentation | 2 |

References

- Bhattachan K.B. and Mishara C. eds. 2000. Devemental Practice in Nepal. Central Development of Sociology and Anthropology, Tribhuvan University, Kathmandu, Nepal.
- Bista D.B. 2010. Fatalism and Development: Nepal's Struggle for Modernization. Orient Longman, Calcutta, India.
- Chitamber J.B. 1997. An Introductory of Rural Sociology. New Age International Private Limited, New Delhi, India.
- Desai A.R. 1995. Rural Sociology in India. Fifth edition. Popular Prakasan Pvt. Ltd., Bombay, India.
- George R. 2005. Sociological Theory. Mc Graw Hill Book Company USA/Singapore.
- Gurung S.B. 1998. Rural Development Approach in Nepal. Deva Publication, Kathmandu, Nepal.
- Mathema D.R. and Kanhiya R.B. 2000. Strategy of Rural Development in Nepal, Some Observation Some Thoughts. Sewa Printing Press, Kathmandu, Nepal.
- Regmi M.C. 1990. Land Ownership in Nepal. Adroit Publication, New Delhi, India.
- Robert C. 1992. Rural Appraisal, Rapid, Related and Participatory. Institute of Development Studies, Sussex, UK.
- Shankar Rao C.N. 2008. Sociology. Sixth revised edition. S. Chand Limited and Company.
- Singh K. 1998. Rural Development: Principle, Policies and Management. Sage Publication.



Dr. Ishwara

Code No: ECN 111

Course Title: Principles of Economics

Credits: 3+0

Nature of Course: Theory

Teaching Hours: 45

Objectives: Upon the completion of the course students will be able to understand and explain the economic theories of production, consumption, distribution and welfare; price and output determination under different markets; national income, financial institutions, basic characteristics and issues related to Nepalese economy.

Course Contents

Theory (45 hours)

Unit 1: Concept and definition of economics: concept and meaning of economics, definitions of economics (Adam Smith, Marshall and Robbins), subject matter of economics, positive and normative analysis (2 hrs)

Unit 2: Basic concepts: want, need, effort and means, satisfaction, goods and services, commodity, consumption, utility, wealth, value, income (2 hrs)

Unit 3: Utility theory: cardinal utility and ordinal utility, law of diminishing marginal utility, assumptions of the law of diminishing marginal utility, limitations of the law of diminishing marginal utility, equilibrium of consumer through cardinal utility analysis (3 hrs)

Unit 4: Indifference curve: indifference schedule, indifference curve and indifference map, assumptions of indifference curve, properties of indifference curve, consumer's equilibrium through indifference curve analysis (2 hrs)

Unit 5: Demand: meaning, demand schedule and demand curve, law of demand, determinants of demand, elasticity of demand (price elasticity of demand, income elasticity of demand, cross elasticity of demand), types of the elasticity of demand, measurement of the elasticity of demand (4 hrs)

Unit 6: Supply: meaning, supply schedule and supply curve, law of supply, determinants of supply, elasticity of supply, types of the elasticity of supply, measurement of the elasticity of supply (3 hrs)

Unit 7: Cost: cost concepts, types of costs, cost analysis (average cost, marginal cost), short-run and long-run cost curves and their relationships, cost function and determinants of cost (5 hrs)

Unit 8: Market and price determination: meaning and types of market, market structure, characteristics of perfect competitive market, monopoly market, monopolistic market and oligopoly market; Price determination under perfect competition market: short-run and long-run equilibrium of firm and industry; Equilibrium price-output determination under monopoly, monopolistic and oligopoly markets; Social market and price determination (5 hrs)

Unit 9: Production: concept, production function, factors of production (land, labor, capital, and organization), characteristics of land and theories of rent, characteristics of labor and theories of wage, characteristics of capital and theories of interest, economies of scales (internal and external economies) (5 hrs)

Unit 10: Laws of returns: law of variable proportions (law of diminishing returns), stages of production, returns to scale (3 hrs)

Unit 11: Money and banking: concept and characteristics of money, functions of money, money market, and functions of bank (2 hrs)

Unit 12: National income accounting systems: concept, meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, gross domestic product (GDP), gross national product (GNP)

and net national product (NNP) (2 hrs)



Unit 13: Tax: concept and meaning, direct and indirect taxes, value added tax (VAT) (2 hrs)

Unit 14: Economic systems: concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies (2 hrs)

Unit 15. Nepalese economy: (i) Nepalese economy: characteristics and problems. (ii) Issues on economic development in Nepal. (iii) Current balance of payment situation of Nepal. (3 hrs)

Reference books

1. Chopra, P.N. 2012. Principles of Economics. Kalyani Publishers, New Delhi.
2. McConnell, C.R. 1975. Economics: Principles, Problems, and Policies. McGraw-Hill, USA.
3. Dahal M.K. ed. 1993. Future of Nepalese Economy. NEFAS, FES, Kathmandu, Nepal.



Code No: PHE 110

Course Title: Yoga

Credits: 0+1

Nature of Course: Practical

Teaching hours: 30

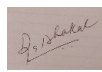
Objectives: Upon the successful completion of the course the students will be able to understand and appreciate the basic concepts and importance of yoga in human health and wellbeing and demonstrate the basic yogic practices.

Course content: (30 Hrs)

| SN | Topics | Practical |
|----|---|-----------|
| 1 | Yoga: etymology, definition, objectives and misconception | 1 |
| | Importance of Yoga in health and well- being of human life | 1 |
| 2 | Yoga: origin, history and development | 1 |
| 3 | Prayer: concept and recitation of Pranava and hymns | 1 |
| 4 | Yoga Cleansing Techniques: Dhauti, Neti, and Kapalbhati | 1 |
| 5 | Yogic Sukshma Vyayama (Micro circulation): Neck movement, shoulder movement, trunk movement, knee movement and ankle movement | 1 |
| 6 | Yogic SthulaVyayana (Macro circulation): Sarvanga Pusti and Hrid Gati (Engine Daud) | 1 |
| 7 | Yogic Surya Namaskar | 1 |
| 8 | Yogasana | 2 |
| 9 | Preparatory Breathing Practices | 1 |
| 10 | Pranayana | 1 |
| 11 | Understanding Bandha | 1 |
| 12 | Understanding of Mudra | 1 |
| 13 | Practices leading to Meditation and Dhyana | 1 |


References:

Ramdev Swami. 2007. *Goga Sadhana and Goga Chikitsa Rahasya*. Second edition, Sai Security Printers Pvt Ltd, 152 DLF Industrial Area. Faridabad, Hariyana, India



Semester II

| Course Code | Title of Course | Credit |
|-------------|--|----------|
| BCH 120 | General Biochemistry | 2+1 |
| SOS 122 | Soil Fertility, Fertilizers and Integrated Nutrient Management | 2+1 |
| PLP 121 | Introductory Plant Pathology | 2+1 |
| MIB 120 | Agriculture Microbiology | 2+1 |
| ANS 122 | Ruminant Management | 1+1 |
| EXT 122 | Extension Education and Communication | 2+1 |
| ENT 121 | Principles of Entomology | 2+1 |
| HRT 122 | Ornamental Horticulture | 2+1 |
| | Total | 15+8= 23 |



Course code: BCM 120

Course Title: General Biochemistry

Credit 2+1

Nature of Course: Theory + Practical

Teaching Hours (30+30)

Objectives: After completion of the course, the students will be able to understand macromolecules of living cells and their metabolism.

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: biochemistry and its relationship with other sciences like agriculture, biotechnology and biological sciences: water as molecule of life: physical and chemical properties, hydrogen bonding and unusual properties of water for survival of lives, pH and buffer, Henderson Hassalbalch equation, buffers of biological system, titration curve. 4 hrs

Unit 2. Carbohydrate: introduction, functions, classification, structure, linear and cyclic form of mono-saccharides, glucose and fructose; structure and importance of sucrose, maltose, lactose, starch and cellulose and properties of mono-saccharides, disaccharides and polysaccharides, and reducing sugar. 5hrs

Unit 3. Protein: introduction, functions, classification, structure of amino acids, ionization of amino acids and titration curve, peptide bond, polypeptides; conformation of protein: primary, secondary, tertiary and quaternary structure. 5hrs

Unit 4. Lipid: introduction, functions, classification, structure and types of fatty acids- triacylglycerol, essential fatty acids, polyunsaturated fatty acids and importance; structure and functions of glycerophospholipids and sphingophospholipids, lipid bilayer as biological membrane. 4 hrs

Unit 5. Enzymes: nomenclature, classification, functions of enzymes, properties of enzymes, factors affecting enzyme activity, co-enzymes, co-factors, allosteric enzymes, enzyme kinetics, inhibition of enzyme activity, mechanism of action, regulation of enzyme activity. 6 hrs

Unit 6. Nucleic acids: nucleic acids types and functions, components of DNA and RNA, nitrogen bases, pentose sugar and phosphate structure, nucleosides, nucleotides and polynucleotides structure double helical structure of DNA (Watson-Crick model), various forms of DNA; denaturation of DNA, RNA and its types, structure, DNA replication, transcription and translation, genetic code. 6 hrs

B. Practical exercise (30 Hrs)

| SN | Topic | Practical |
|----|--|-----------|
| 1 | Preparation of different solutions(percent, molar and normal solutions) | 2 |
| 2 | Determination of pH and preparation of different buffer solutions | 2 |
| 3 | Qualitative tests of carbohydrates-Molisch's test, Iodine test, Seliwanoff test | 2 |
| 4 | Test for reducing sugar- Benedict's test, Fehling's test | 2 |
| 5 | Test for amino acids and protein | 2 |
| 6 | Tests for lipid-Schiffs test, Salkowski test, Acid value of fat | 2 |
| 7 | Extraction of water soluble sugar from plant material and its quantitative estimation. (Spectrophotometer) | 2 |
| 8 | Effect of enzyme concentration, substrate concentration, pH and temperature on | 2 |

| | | |
|----|---|----|
| | activity of catalase and amylase. | |
| 9 | Sucrase activity of yeast | 2 |
| 10 | Separation technique (i) paper chromatography (ii) thin layer chromatography. | 4 |
| 11 | Extraction and estimation of nucleic acid in plant material. (Spectrophotometer). | 2 |
| 12 | Extraction and absorption spectrum of DNA & RNA. | 4 |
| 13 | Determination of protein content by Kjeldahl method | 2 |
| | Total | 30 |

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Nelson DL and Cox MM (2004). Lehninger Principles of Biochemistry, 5th Edition. Freeman Publication.

Stryer L (1995). Biochemistry, 4th Edition. W.H. Freeman Company, New York.

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
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Ahmad, M. 1995. Modern biochemistry (Vol I and II). Oxford and IBH Publication, Co., Pvt, Ltd, New Delhi.

Rameshwar, A. 1993. Practical Biochemistry. A basic course. Kalyani Publication, New Delhi.

Buchanan B., Wilhelm G. and Russell J., eds. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists, Rockville, USA.

Rastogi S.C. 1993. Biochemistry. Tata McGraw-Hill Publishing Company Ltd., New Delhi, India.



Code No: SOS 122

Course Title: Soil Fertility, Fertilizers and Integrated Nutrient Management

Credits: 2+1

Nature of Course: Theory + Practical

Teaching Hours: 30+30

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction to Soil fertility and Productivity

1hrs.

- a. Definition, concept, importance and factors affecting soil fertility and productivity
- b. Historical development of soil fertility and plant nutrition

Unit 2. Essential Plant Nutrients

6hrs

- a. Definition of plant nutrients, types of nutrients elements, essential nutrients/elements and definition, classification of essential nutrients, beneficial nutrients/elements, definitions of primary, secondary and micro-nutrient: criteria of essentiality of nutrients.
- b. Sources, functions, deficiency symptoms and control measure, toxicity symptom and availability to plants.
- c. Mechanism of nutrient transport to plants and factors influencing nutrient availability to plants

Unit 3. Fertilizers

7hrs

- a. **Nitrogenous fertilizer:** definition, classification, manufacturing process, characteristics, reactions of fertilizer in soil and fertilizers use efficiency.
- b. **Phosphatic fertilizer:** definition, classification, manufacturing process, characteristics, reactions of fertilizer in soil and fertilizers use efficiency.
- c. **Potassic fertilizer:** definition, classification, manufacturing process, characteristics, reactions of fertilizer in soil and fertilizers use efficiency.
- d. **Secondary(Ca, Mg, S) and Micronutrient fertilizer:**

Unit 4. Organic Manures

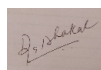
4hrs

- a. Bulky organic manures (FYM: compost, night soil, green manure, sewage and sludge and bio-gas slurry), importance, preparation method, factor affecting their composition.
- b. Concentrated organic manures: oil cakes, blood meals, meat meals, fish meal, guano, poultry manure: importance and nutrient content in them.
- c. Bio-fertilizers : definition, types and their advantages.
- d. Green manure and its importance
- e. Bio-gas slurry and its importance

Unit 5 Soil Fertility Evaluation

4hrs

- a. Visual symptoms of nutrient deficiencies, plant and tissue analysis, biological test and chemical soil test.
- b. Soil test in crop response and correlation, fertilizer recommendation based on soil test



Unit 5. Influence of Fertilizer on Environment**2hrs**

- Nitrate pollution, eutrophication, green-house gases emission due to use of organic and inorganic fertilizer.
- Fertilizer management to reduce environmental effect: best management practices (BMPs) – Nitrogen-BMPs, Phosphorous-BMPs, Potassium- BMPs.

Unit 6. Sustainable Soil Management and Balanced Fertilization**4hrs**

- Concept of sustainable soil management, components of SSM, principles of SSM, fertilizer for soil improvements, farm yard manure (FYM) improvement , urine collection and utilization, SSM practice in Nepal
- Concept of balanced fertilization, principles (nutrient and crop yield relationship; (*Leibig's Law, Mitscherlich's law of diminishing return, quadric function*); nutrient interaction, nutrient behavior in soil, optimal nutrient content of plants and soil (sufficiency/deficiency level), criteria of nutrients requirement; Integrated Plant Nutrient Management system: concepts, components and importance.

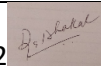
Unit 7. Nutrient Use Efficiency**1hrs**

- Factors influencing nutrient use efficiency (NUE) in respect of N, P, K
- Maximum economic yield (calculation of fertilizer rate for maximum yield, fertilizer rate for maximum profit).
- Soil fertility problems with respect to Nepalese agricultural system

Unit 8. Nutrient Cycling Processes**1hrs**

Concept, components involved in nutrient cycling process, ways of nutrient cycling in soil, effect of deforestation and crop harvesting on nutrient cycling; role of microbes in nutrient cycling

B. Practical exercise 15 (30 Hrs)

| SN | Exercise | Practical |
|----|---|---|
| 1 | Soil sampling and preparation for soil fertility analysis. | 1 |
| 2 | Chemical calculation and preparation of standard solution | 1 |
| 3 | Determination of organic matter content in soil | 1 |
| 4 | Basics principles of micro-Kjeldahl distillation assembly, spectrophotometer, flame photometer. | 1 |
| 5 | Determination of total nitrogen, available phosphorus and available potassium in soil. | 3 |
| 6 | Plant sampling, preparation and preservation for analysis | 2 |
| 7 | Organic carbon and moisture content in FYM/compost | 1 |
| 8 | Analysis of nitrogen content in urea | 2  |
| 9 | Moisture content in fertilizers | 1 |

| | | |
|----|------------------------------------|----|
| 10 | Phosphorous content in DAP/SSP/TSP | 1 |
| 11 | Potassium content in MOP | 1 |
| | Total | 15 |

References

Brady, N.C. and Ray R. Weili. 2012. The Nature and Properties of Soils, 14th Edition, Prentice- Hall.Inc.,

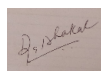
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Roy, R.N. 2006. Plant Nutrition for Food security: a guide for integrated nutrient management. FAO.

Tisdale, S.L., W.L. Nelson, J.D. Beaton and J.L. Havlin. 1993. Soil fertility and Fertilizers, 5th Edition. P.F. Corey(ed),
Macmillan Publishing Co.,866 Third Avenue, New York

Robert E. White. 2009. Principles and Practice of Soil Science. The soil as a natural resource 4th Ed. Blackwell Publishing Co.

Nagornny V. D. and Raghav J. S. 2015. Soil Fertility Management Reprint. Kalyani Publishers Pvt. Ltd., New Delhi



Code No: PLP 121

Course Title: Introductory Plant Pathology

Credits: 2+1

Nature of Course: Theory + Practical

Teaching Hours: 30+30

Objectives: This course will enable the students to understand the basic principles of plant pathology, explain the reoccurrence and spread of the plant pathogens, and identify the major causal organisms (fungi, bacteria and nematodes).

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: Definition and scope; basic principles of plant pathology, plant disease classification, and general symptoms. **2 Hrs**

Unit 2. Fungi: Morphological characters of fungi, asexual/sexual reproduction and fruiting bodies; classification of fungi with their diagnostic characters. Myxomycota: *Plasmodiophora* and *Spongospora*. Mastigomycotina: *Synchytrium*, *Pythium*, *Phytophthora*, *Albugo*, *Sclerospora*, *Plasmopara*, and *Peronosora*. Ascomycotina: *Taphrina*, *Protomyces*, *Erysiphe*, *Claviceps*. Basidiomycotina: *Puccinia*, *Melampsora*, *Uromyces*, *Ustilago*, & *Tilletia*. Deuteromycotina: *Colletotrichum*, *Alternaria*, *Cercospora*, *Fusarium*, *Helminthosorium*, *Pyricularia*, *Sclerotium*, *Sclerotinia*, *Rhizoctonia*. **9 Hrs**

Unit 3. Bacteria: Definition, general morphology of bacterial cell and their functions. Classification, and characteristics of *Xanthomonas*, *Pseudomonas*, *Erwinia*, *Agrobacterium*, *Corynebacterium* and *Streptomyces*. **5 Hrs**

Unit 4. Viruses, Mycoplasma and Spiroplasma: Characteristics of virus; virus multiplication and transmission, Mycoplasma and Spiroplasma characters. **2 Hrs**

Unit 5. Other pathogens: General characteristics, life cycle and reproduction of nematode; characteristics of *Anguina*, *Heterodera*, *Meloidogyne* and *Hirschmaniella*. **4 Hrs**

Unit 6. Other topics: Pathogenecity and pathogenesis; survival and dissemination of plant pathogens; epidemiological study; pre/ post-exposed defense mechanisms; physiology of infected plants; enzymes, microbial toxins; disease forecasting and principles of disease management. **8 Hrs**

B. Practical (30 Hrs)

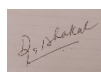
(i) Study about microscope. (ii) Differentiation between abiotic and biotic plant diseases. (iii) Cleaning and sterilization of glasswares. (iv) Preparation of PDA tube and plate. (v) Isolation of fungi from diseased plant and soil. (vi) Identification of fungi. (vii) Calibration and measurement of fungal spores. (viii) Media preparation for bacterial isolation. (ix) Isolation and identification of Gram +ve and -ve bacteria. (x) Extraction and identification of soil nematode- pathogenic and saprophytic.

References

Chaube H.S. and Singh R. 2001. *Introductory Plant Pathology*. International Book Distributing Company, Lucknow, India.

Singh R.S. 1994. *Plant Pathogens: The Fungi*. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, India.

Singh R.S. 1999. *Introduction to Principles of Plant Pathology*. Third edition. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, India.



Code No: MIB 120

Course Title: Agriculture Microbiology

Credits: 2+1

Nature of Course: Theory + Practical

Teaching Hours: 30+30

Objectives: Upon the completion of course the students will be able to describe basic characteristics of various micro-organism, their roles in soil fertility and plant growth and gain basic skill in laboratory techniques, isolation and mass production of microorganisms.

Course Contents

A. Theory (30 Hrs)

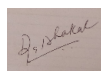
Unit I History and scope of microbiology and bacterial cell structure. Definition and scope-Spontaneous generation theory. Contributions of Anton Von Leeuwenhoek, Louis Pasteur, John Tyndall, Robert Koch, Edward Jenner, Joseph Lister, Beijerinck, Winogradsky and Waksman; Position of microorganisms in living world; Prokaryotes Vs Eukaryotes; Groups of microorganisms; Bacterial size, shape and arrangement and morphology; functional anatomy of bacteria; structure and organization of a bacterial cell: Invariant and variant components structure and organization of microbial cell, Morphology of fungi and algae- economic importance 5 hrs

Unit II Microbiological techniques Microscopy – principles and types; staining of microorganisms-principles; sterilization and disinfection techniques; principles and methods of sterilization - physical methods – heat, filters, and radiation; chemical methods; isolation of pure culture techniques - enrichment culturing, dilution-plating, streak plate, spread plate methods; preservation of microbial cultures. **7 hrs**

Unit III Microbial physiology and metabolism Bacterial growth, reproduction and factors influencing bacterial growth – Growth curve: environmental condition for growth- nutritional types and metabolic diversity of bacteria; principles of energy generation and carbon metabolism; fermentation–respiration in bacteria- Metabolic diversity in bacteria-overview, outline classification of bacteria – bergey’s manual of systematic bacteriology Edn-II **5 hrs**

Unit IV Soil Microbiology Overview of soil microbiology, definitions- Concepts and scope, discovery, distribution and importance of soil microorganisms in soil fertility - factors affecting the activities of soil microorganisms; Rhizosphere microorganisms and importance; Phyllosphere microorganisms - plant-microbe and microbe-microbe interactions in soil. **5 hrs**

Unit V Microbial transformation of nutrients in soil Microbial transformation of nutrients in soil - carbon, phosphorous and sulphur cycle; nitrogen cycle, biological nitrogen fixation - symbiotic and non-symbiotic microorganisms, Process of nodulation and nitrogen fixation; Silicate and zinc solubilising bacteria - types and importance of biofertilizers in agriculture; mass production and quality control of biofertilizers 8 hrs.




B.Practical (30 hours)

1. Handling light microscope.
2. Staining techniques -Simple and Differential staining
3. Sterilization -equipment and apparatus used for sterilization
4. Media preparation for bacteria, fungi and actinomycetes
5. Enumeration of soil microorganisms - serial dilution plate technique (bacteria, fungi, and actinomycetes)
6. Purification and preservation of bacteria & fungi
7. Morphological and biochemical characters of bacteria.
8. Conn's direct microscopic count and Burried slide technique.
9. Organic matter decomposition - measurement of CO₂ evolution.
10. Demostration of antibiosis – crowded plate assay
11. Isolation of symbiotic, non symbiotic and associative N₂ fixing microorganism – Rhizobium, Azospirillum and Azotobacterillum and Azotobacter
12. Mass production of biofertilizers

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3. Prescott, M.J., Harley, J.P. and Klein, D.A. 2002. Microbiology. 5th Edition, WCB Mc GrawHill, New York.
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Course Title: Ruminant Management

Credits: 1+1

Nature of Course: Theory + Practical

Teaching Hours: 15+30

Objectives: Upon the completion of the course the students will be able to identify different breeds of farm animals and have knowledge and skill in management practices

Course Contents**A. Theory (30 Hrs)**

| Topic | Lecture |
|--|-----------|
| Unit 1. Introduction: importance, scope and statistics of ruminant in Nepal | 1 |
| Unit 2. Review of indigenous and exotic breeds and their characteristics of cattle, buffalo, yak, sheep and goat | 3 |
| Unit 3. Rumen ecosystem and functions | 1 |
| Unit 4. Care and management of cattle, buffalo, Yak, sheep and goat (pregnant and lactating) | 2 |
| Unit 5. Principle of housing and different housing system of ruminant (cattle, buffalo, sheep and goat) | 2 |
| Unit 6. Artificial rearing of new born ruminant | 1 |
| Unit 7. Importance and methods of castration, dehorning, grooming, dipping, shearing of wool, grading quality of wool, dusting of farm animals | 2 |
| Unit 8. Judging and selection of animals | 1 |
| Unit 9. Importance and use of draft animals | 1 |
| Unit 10. Different milking methods and their practices | 1 |
| Total | 15 |

B. Practical exercise 15 (30 Hrs)

| SN | Exercise | Practical |
|----|---|-----------|
| 1 | Different types of housing system on farm | 2 |
| 2 | Castration of bull, buck and ram | 2 |
| 3 | Grooming of cattle and buffalo | 1 |
| 4 | Dipping of sheep and goat | 1 |
| 5 | Dehorning of cattle and buffalo | 2 |

| | | |
|----|---|----|
| 6 | Shearing of sheep | 1 |
| 7 | Cleaning of barn and milking parlor | 2 |
| 8 | Milking practices | 1 |
| 9 | Identification, characterization and familiarization with different breeds of cattle, buffalo, sheep and goat | 2 |
| 10 | Record and record keeping | 1 |
| | Total | 15 |


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Code No: EXT 122

Course Title: Extension Education and Communication

Credits: 2+1

Nature of Course: Theory + Practical

Teaching Hours: 30+30

Course Contents

A. Theory (30 Hrs)

Unit 1. Education: meaning, Concept, types and objectives of education, formal, non-formal and informal education, role of non-formal education in rural development. 2 hrs

Unit 2. Extension education: origin, meaning, history of extension education; principles and philosophy, role of extension in agriculture development, extension system in Nepal. 4 hrs.

Unit 3. Teaching-learning: concept and laws of learning, principles of learning, principles of teaching learning in adult education, factors affecting adult education. 4 hrs

Unit 4. Extension teaching method: definitions, classification of extension teaching methods-individual, groups, mass contact method, Audio-visual aids. 4 hrs

Unit 5. Extension program planning: definition, importance and principles of program planning, steps in program planning. 3 hrs

Unit 6. Leader and Leadership: meaning, elements of leadership, types and methods of discovering leaders. 2 hrs

Unit 7. Adoption and diffusion: adoption and diffusion of innovation, meaning, adoption process, adopter's categories. 2 hrs

Unit 8. Communication: concept, definition and role of communication in extension education, types of communication, feedback in communication, organizational communication in agriculture development, communicator and communicatee relationship, problem in communication, interpersonal communication and mass media in developing societies. 4 hrs.

Unit 9. Communication aids: audio aids, visual aids, audio-visual aids and other teaching aids, communication through written words, satellite and message design. 3 hrs

Unit 10. Factors affecting communication behavior: social, personal, cultural and situational; communication in organization. 2 hrs.

B. Practical exercise(30 Hrs)

| SN | Exercise | Practical |
|----|--|-----------|
| 1 | Visit to different agricultural organization (AKC, AC) to study working procedures, program development and implementation, goal, achievement and linkage. | 4 |
| 2 | Visit and interaction meeting with commercial farmers groups | 3 |
| 3 | Interaction, visit and meeting with NGO/CBOs/Co-operative/Private sector and its local group and study their program planning. | 2 |
| 4 | Study the methods of working through functional leaders in a community. | 2 |
| 5 | Designing and preparation of audio-visual materials such as poster, pamphlet, leaflets, booklet etc. | 2 |
| 6 | Handling of audio-visual equipment - overhead projector, slide projector, camera | 2 |

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Dr. Ishwari

Code No: ENT 121

Course Title: Principles of Entomology

Credits: 2+1

Nature of Course: Theory + Practical

Teaching Hours: 30+30

Objectives: Upon the completion of this course, the students will be able to understand the fundamentals of introductory entomology, and learn about valuable insects, such as honeybee, silkworm and lac insects.

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: definition, position of insects in animal kingdom; reasons for the dominance of insects over other animals; beneficial and harmful insects. **4 Hrs**

Unit 2. External morphology, body regions: head, thorax and abdomen, external processes, cuticle; head: segmentation, structure, modifications, mouth parts and their modifications, antennae and their modifications, photoreceptors (compound eyes, ocelli and stemmata); thorax: segmentation, structure, legs and their modifications, wing venation and their modifications; abdomen: segmentation and structure, abdominal appendages. **8 Hrs**

Unit 3. Internal anatomy: digestive, reproductive (male and female), respiratory, circulatory, nervous and excretory systems. **5 Hrs**

Unit 4. Insect metamorphosis and development. **2 Hrs**

Unit 5. Classification and study of economically important orders and families of insects: orders – Thysanura, Odonata, Orthoptera, Dictyoptera, Isoptera, Mallophaga, Siphunculata (Anoplura), Thysanoptera, Hemiptera (Heteroptera), Homoptera, Siphonaptera, Coleoptera, Lepidoptera, Diptera, and Hymenoptera. **8 Hrs**

Unit 6. Introduction to Industrial Entomology: apiculture, sericulture, lac-culture. **3 Hrs**

B. Practical (30 Hrs)

(i) Collection and preservation of insects. (ii) External morphology of an insect. (iii) Insect mouth, antennae, legs, wings and their modifications. (iv) Internal anatomy of an insect (digestive, reproductive – male and female, nervous, circulatory and respiratory systems). (v) Insect metamorphosis. (vi) Types of larvae and pupae. (vii) Life-cycle of honeybee, silkworm and lac insects. (viii) Classification of insects: important families of the orders Thysanura, Odonata, Orthoptera, Dictyoptera, Hemiptera, Homoptera, Coleoptera, Diptera, Lepidoptera, Hymenoptera and other orders of economic importance.

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Code No: HRT 122

Course Title: Ornamental Horticulture

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: Upon the completion of the course the students will be able to understand the importance and scope of ornamental plants in Nepal and explain the basic principles and practices of landscaping, gardening and bio-aesthetic planning,

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction to ornamental horticulture: ornamental horticulture, history of ornamental horticulture and floriculture industry in Nepal, area and production scope and future potential of ornamental horticulture in Nepal. 2hr

Unit 2. Introduction to important ornamental crops in Nepal: ornamental plants, types of ornamental plants, classification of ornamental plants based on life cycle, growth habit and use; types of trees, shrubs, herbaceous perennials, annuals and their basic production and use in ornamental horticulture, use of ornamental plants as avenue plantation, hedges, edges, cluster planting or standard in the landscape. **7 Hrs**

Unit 3. Introduction to gardening and landscaping: history, scope of gardening, aesthetic values, gardens in Nepal, types of gardens, landscaping, historical background, definition. **3 Hrs**

Unit 4. Principles of gardening and landscaping: principles of gardening, garden components, adornments, lawn making, methods of designing rockery and water garden, landscaping, basic principles and basic components. **3 Hrs**

Unit 5. Garden types, features and components: special types of gardens, their walk-paths, bridges, constructed features, greenhouse, special types of gardens, trees, their design, values in landscaping, propagation, planting shrubs and herbaceous perennials. Importance, design values, propagation, planting, climbers and creepers, palms, ferns, grasses and cacti succulents. **5 Hrs**

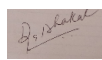
Unit 6. Floral arrangement and bonsai: flower arrangement- importance, production details and cultural operations, constraints, post-harvest practices culture of bonsai, art of making bonsai. **3 Hrs**

Unit 7. Bio-aesthetic planning: bio-aesthetic planning, definition, need, rural country planning, urban planning and planting avenues, schools, villages, beautifying railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for play grounds, vertical gardens, roof gardens, parks and public gardens. 5Hrs

Unit 8. Post- harvest handling of cut flowers and foliage 2 Hrs

B. Practical (30 Hrs)

Identification and description of annuals (n = 30), herbaceous perennials (n = 30), climbers (n = 10), creepers (n = 10), foliage and flowering shrubs (n = 30), trees (n = 40), palms (n = 10), cacti and succulents (n = 10), ornamental grasses (n = 5). Planning and designing gardens, layout of location of components of garden study, functional uses of plants in the landscape. Planning design of house garden, avenues for civil colonies, preparation of land for lawn and planting. Description and design of garden structures, layout of rockery, water garden, terrace garden, and Japanese gardens. Layout of terrarium, flower arrangement, bonsai practicing and training. Visit to nearby gardens.



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
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YEAR II

Semester I

| Course Code | Title of Course | Credit |
|-------------|--|---------|
| PLB 211 | Genetics | 2+1 |
| AGR 212 | Cereal Crop Production | 2+1 |
| MAP 210 | Medicinal and Aromatic Plant | 1+1 |
| PLP 212 | Crop Disease Management | 2+1 |
| ENT 212 | Crop Insect Pest Management | 2+1 |
| SOS 213 | Soil Physics, Genesis and Classification | 2+1 |
| HRT 213 | Plantation and Spice Crops Production | 1+1 |
| ANS 213 | Pig and Poultry Management | 1+1 |
| | Total | 13+8=21 |



Code No: 211

Course Title: Genetics

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: Upon the completion of course, the student will be able to understand the fundamental principles of genetics, the mechanism of inheritance, gene manipulation and solve the numerical problems related to inheritance of quantitative, qualitative and cytoplasmic characters

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: definition, importance, scope and relationship with other disciplines; history. 1 Hr

Unit 2. Cell: cell structure, organelles and their functions; cell division and cell cycle (mitosis and meiosis) 3 Hrs

Unit 3. Nucleic acid: structure, functions and synthesis of nucleic acids, DNA replication, RNA and its types, transcription, translation and genetic code. 4 Hrs

Unit 4. Life cycle: maize and human, bacteria and virus. 3Hrs

Unit 5. Mendelian genetics: introduction to Mendelian genetics, Mendel's law of inheritance, back cross and test cross. 3Hrs

Unit 6. Gene action and interaction, linkage and crossing over, probability and chi-square testing. 5 Hrs

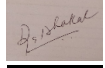
Unit 7. Sex determination: sex determination in animal, plant and sex linkage. 3 Hrs

Unit 8. Cytoplasmic inheritance: gene in organelles and maternal effects, characteristics of cytoplasmic inheritance, male sterility, restore and non-restore genes. 2Hrs

Unit 9. Gene regulation and transposable genetic elements, gene transfer methods and transgenic plants, their uses and issues. 3 Hrs

Unit 10. Mutation and mutagens: definition, characteristics and types of mutation; mutagens and types of mutagens, use of mutation; chromosomal aberration (structural and numeric). 3Hrs

B. Practical (30 Hrs)

| SN | Topic | Practical |
|----|--|---|
| 1 | Study of diagrams of mitosis and meiosis | 2 |
| 2 | Microscopic study of different stages of mitosis and meiosis | 2 |
| 3 | Microscopic study of DNA and RNA | 1 |
| 4 | Solution of numerical problems related to Mendel's law of segregation, | 1 |
| 5 | Solution of numerical problems related to Mendel's law of independent assortment | 1 |
| 6 | Solution of numerical problems related to gene action | 1 |
| 7 | Solution of numerical problems related to gene interaction |  |
| 8 | Probability | 1 |

| | | |
|----|--|---|
| 9 | Chi square test | 1 |
| 10 | Solution of numerical problems related to linkage | 1 |
| 11 | Solution of numerical problems related to crossing over | 1 |
| 12 | Solution of numerical problems related to sex determination and linkages | 1 |
| 13 | Field observation of cytoplasmic or genetic male sterility | 1 |

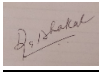
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Code No: AGR 212

Course Title: Cereal Crop Production

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: Upon the completion of the course, the students will be able to understand the major constraints, climatic and soil requirement, distribution in Nepal, crop species, recommended and registered varieties, improved cultivation practices, harvesting, threshing and storage of rice, maize, wheat, barley, finger millet and buckwheat.

Course Contents

A. Theory (30 Hrs)

Unit 1. Rice : Introduction and importance, origin, distribution, area, production and productivity constraints of production in Nepal, soil and climatic requirement, growth stages, sub species- indica, japonica and javanica, important varieties and hybrids of rice in Nepal, system of rice culture, land preparation and puddling, raising of nurseries: wet, dry, dapog and modified dapog nurseries, seed rate, seed treatment and spacing, fertilizer management, integrated nutrient management, steps for increasing fertilizer use efficiency, water management practices, Weeds and weed control, maturity judging, harvesting, threshing, cleaning, drying and storage 10 hrs

Unit 2. Maize: Introduction and importance, origin, distribution, area, production and

productivity, constraint of production in Nepal, Soil and climatic requirement, classification, important varieties and hybrids, growth stages, land preparation, seed treatments, seed rate, spacing, sowing time, sowing methods, fertilizer and water management, weed management and interculture operation, maturity judging, harvesting, threshing, drying and storage. 6 hrs

Unit 3. Wheat: Introduction and importance, origin, distribution, area, production and productivity, constraints of production in Nepal, growth stages, soil and climatic requirement, classification, important varieties, land preparation, seed treatments, seed rate, spacing, sowing time, sowing method, fertilizer, irrigation and weed management, maturity judging, harvesting, threshing, cleaning, drying and storage, rice-wheat system in Nepal. 6hrs

Unit 4. Barley : Introduction and importance, origin, distribution, area, production, productivity and constraints of production in Nepal, soil and climatic requirement, classification, important varieties, land preparation, seed and sowing, fertilizer, irrigation, and weed management, harvesting, threshing, cleaning, drying and storage 2hrs

Unit 5. Finger millet: Introduction and importance, origin, distribution, area, production and productivity and constraints of production in Nepal. classification and recommended varieties, land preparation, seed and sowing, nursery raising and transplanting, fertilizers, weed and water management, Maturity judging, harvesting, threshing, cleaning, drying and storage 2hrs

Unit 6. Buckwheat: Introduction and importance, origin, distribution, area, production and productivity and constraints of production in Nepal. classification and important varieties, land preparation, seed and sowing, fertilizers, weed and water management, Maturity judging, harvesting, threshing, cleaning, drying and storage 2hrs

Unit 7. An introduction to minor cereals in Nepal: Sorghum, Pearl millet, Foxtail, and Proso millet, importance, distribution, and agronomy of producing higher yield.- 2hrs




B.Practical (30 hrs)

| S. No. | Topic | No. of Practical |
|--------|--|------------------|
| 1. | Raising of rice seedling by various methods | 1 |
| 2 | Study of morphological characteristics and growth stages of rice wheat and maize | 2 |
| 3 | Nitrogen application in rice through leaf color Chart (LCC)/ SPAD | 1 |
| 4 | Land preparation and planting of seasonal crops | 2 |
| 5 | Practice on numerical exercise of fertilizers and herbicides application in summer crops | 2 |
| 6. | Study of yield attributes and estimation of the yield of seasonal crops | 2 |
| 7. | Identification of weeds/ control weeds of cereal crops | 2 |
| 8. | Visit to agronomy farm/ research station | 1 |
| 9. | Layout of field, designing of an experiment and planting crops in experimental plots | 1 |
| 10. | Taking data from experimental field or survey of farmers field for getting information on agronomic management | 1 |

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Code No: MAP 210

Course Title: Medicinal and Aromatic Plants

Credits: 1+1

Nature of Course: Theory + Practical

Teaching hours: 15+30

Objectives: The students will be able to identify the major issues in medicinal and aromatic plants and gain basic knowledge on the management and production and processing technology of important medicinal and aromatic plants.

Course Contents

A. Theory (15 Hrs)

Unit 1: Introduction: importance, scope and economic potentiality of medicinal and aromatic plants in national economy of Nepal: diversity, distribution, trade potentials; opportunities and constraints in the cultivation of medicinal and aromatic plants in Nepal. 2 Hrs

Unit 2: Sustainable use of medicinal and aromatic plants: major conservation issues, sustainable use and management: opportunities and constraints in domestication of wild aromatic and medicinal plants; alternatives to wild harvest; eco-certification process and mechanism; national policies; community-based management. 2 Hrs

Unit 3. Cultivation technologies: uses (traditional and commercial), origin, distribution, area of production, climatic and soil requirements, nursery management, cultivation technologies of important species of medicinal and aromatic plants: *Acorus calamus* (bojho), *Asparagus racemosus* (Kurilo), *Bergenia ciliate* (pakhnev), *Cinnamomum glaucescens* (sinkaulee, sugandhkokila), *Cinnamomum tamala* (Tejpat), *Cymbopogon flexuosus* (Lemongrass), *Cymbopogon martini* (pamroja), *Cymbopogon winterianus*, *Dactylorhiza hatagirea* (Panchaule), *Dioscorea* spp. (tarul/bhyakur), *Gaultheria fragrantissima* (Dhasingaare/kaalgeri), *Matricaria chamomila*, *Mentha arvensis* (Japani pudina), *Neopicrorhiza scrophulariiflora* (kutki), *Paris polyphylla* (satuwa), *Phyllanthus emblica* (Amala), *Piper longum* (Pipla), *Rauvolfia serpentine* (Sarpagandha), *Rheum australe* (padamchaal), *Rubia manjith* (majitho), *Sapindus mukorossi* (ritha), *Swertia chirayita* (Chiraito), *Taxus wallichiana* (Dhengre salla), *Valeriana jatamansi* (Jatamasi) and *Zanthoxylum armatum* (Timur), *Opicordyceps sinensis* (Yarsa Gumba), *Ocimum tenuiflorum* (Krishna tulasi), rosemary and saffron. 8 Hrs

Unit 4. Harvesting and post-harvesting technologies: Harvesting and post-harvesting technologies of some important species, value addition methods, processing and packaging methods. Phytochemical properties and therapeutic and pharmaceutical uses of end products of some important species. Essential oil technology: extraction, processing and commercialization. 3 Hrs

B. Practical (30 Hrs)

Collection and preparation of at least 20 herbarium specimens representing different families of medicinal and aromatic plants from their natural habitat and study their morphological description, nursery techniques, harvesting, curing and processing techniques and methods of extraction of essential oils and other products.

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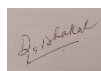
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Code No: PLP 212

Course Title: Crop Diseases Management

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: This course will enable the students to differentiate the fungal, bacterial, viral, nematological and non-pathogenic diseases of plants; identify the major causal organisms of plant diseases, explain the reoccurrence and spread of the diseases in the field, and to determine the control measures of major plant diseases.

Course Contents

A. Theory (30 Hrs)

Unit 1. Fungal diseases: Powdery mildew of pea, cucurbits and apple (2); downy mildew of grape, crucifers and cucurbits (2); damping off of seedlings, root rots and collar rot of citrus and papaya (2); rusts of pea and beans (1); Loose smut and bunt of wheat, covered smut of barley (1); Wilts of guava, arhar, lentil and chickpea (1); Late blight of potato and tomato, mango malformation (1); Blast and leaf spot of rice, leaf blotch of wheat (1); Alternaria leaf spot of and blight of *Brassica*, leaf spot of groundnut (1); Anthracnose of bean, die-back and leaf spot of chilli (1); Stem gall of coriander, and peach leaf curl (1); White rust of Crucifers, Sclerotinia blight of Solanaceous crops (1); Red rust of tea, litchi rust and guava rust (1). 16 Hrs

Unit 2. Bacterial diseases: Leaf blight and leaf streak of paddy, (1); black rot of cole crops and stalk rot of maize (1); citrus canker and brown rot of potato (1). 3 Hrs

Unit 3. Nematological diseases: Root knot of vegetables and rice (1); ear cockle of wheat, golden nematodes of potato (1); white tip of paddy, cyst nematodes (1). 3 Hrs

Unit 4. Viral and Mycoplasmal diseases: Yellow vein of okra, tobacco and tomato mosaic, papaya mosaic (1); Bunchy top of banana and tristeza virus of citrus (1); Virus diseases of potato (1); Bean common mosaic virus, soybean mosaic (1); Little leaf of brinjal and chilli, churki and furki disease of cardamom (1). Non-pathogenic diseases: tip burn, black heart, black tip, khaira; Orobanche on Crucifers and Solanaceous crops (3). 8 Hrs

B. Practical (30 Hrs)

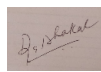
(i) Field visits to collect and identify fungal, bacterial, viral, nematological and non-pathogenic diseases of the crop plants (4). (ii) Collection and preservation of disease specimens (4). (iii) Preparation of temporary slides of fungi, teasing samples and identify organisms (2). (iv) Section cutting of disease specimens to study host-parasite relationship (10). (v) Ooze test for bacterial infection (2). (vi) Study of the root knot nematode (2). (vii) Dilution of the chemicals, handling and calibration of sprayer (4). (viii) Preparation of Bordeaux mixture (2).

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Code No: ENT 212

Course Title: Crop Insect Pest Management

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: This course will enable students to understand the fundamentals of insect pest management, and handle pest management practices independently.

Course Contents

A. Theory (30 Hrs)

Unit 1. Concepts of and approaches to pest management: Agricultural crop pests and pest management concept; elements of plant pest management; pest management approaches: prevention, suppression and eradication; economic levels and economics of pest management; cultural and ecological aspects of pest management; plant resistance in pest management. **3 Hrs**

Unit 2. Pest management methods: Cultural controls; physical and mechanical controls; biological controls: use of insect pathogens, nematodes, predators and parasitoids; legal/legislative control; chemical control: use of selective pesticides, attractants, repellents; genetic control; other methods: use of resistant varieties, behavioral modifications. **5 Hrs**

Unit 3. Insect pests of economically important crops and their management:

- (i) cereal crops, pulse and oilseed; 3 hrs
- (ii) vegetable; 4 hrs
- (iii) fruits; 4 hrs
- (iv) industrial crops (tea, coffee and tobacco), spices and condiments; 4 hrs
- (v) storage grains and their management. 2 hrs

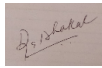
Unit 4. Principles and practice of Integrated Pest Management (IPM): concepts and objectives of IPM, central ideas of IPM: prevention, natural control provided by pest natural enemies; other agricultural decision making tasks. IPM program components: knowledge base – key plants, key pests; monitoring; decision-making rules – thresholds (economic threshold and action threshold); tolerance levels; integration of pest management tactics; evaluation. 5 Hrs

B. Practical (30 Hrs)

(i) Identification of insecticides to their hazard category under laboratory condition. (ii) Insecticides formulations and computation of doses. (iii) Study of general parts of pesticide appliances, their common defects and remedies. (iv) Familiarization with bioassay preparation experiments. (v) Familiarization with scouting techniques to common insect pests at nearby farm. (vi) Identification and uses of microbial pesticides. (vii) Preparation of poison baits and familiarization with male annihilation techniques. (viii) Familiarization with trap crop experiments as a pest management strategy. (ix) Study of botanical materials for storage pest management. (x) Collection and identification of various insect pests of: field crops, vegetable crops, fruit crops, spices and condiments, oilseed crop; identification of pests in storage and their management.

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Code No: SOS 213

Course Title: Soil Physics, Genesis and Classification

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30 +30

Objectives: This course is intended to provide students with the basic knowledge of soil science in relation to soil environment, i.e., water, heat and solutes movement, quantitative measurements, and how they effect on soil characteristics giving rise to the development of different kinds of soils on the landscape.

Course Contents

A. Theory (30 Hrs)

| Unit | Topic | Lecture |
|------|---|---------|
| 1 | Structural property of water, and soil water energy concepts | 3 |
| 2 | Flow of liquid water in soil | 3 |
| 3 | Infiltration, percolation and vapor flow | 3 |
| 4 | Factors affecting plant available soil water | 3 |
| 5 | Weathering of soil forming rocks and minerals | 3 |
| 6 | Diagnostic soil horizons and morphological properties of soil | 3 |
| 7 | Soil moisture and temperature regimes | 3 |
| 8 | Factors affecting soil formation and parent materials | 3 |
| 9 | Comprehensive soil classification system and nomenclature | 3 |
| 10 | Study of formation of soil orders, suborders and great groups for soil classification | 3 |
| | Total | 30 |



B. Practical (30 Hrs)

| S.N. | Topic | Practical |
|------|---|-----------|
| 1 | Determination of soil wetness by gravimetric and volumetric methods and express in terms of depth of water in the soil | 1 |
| 2 | Volume and mass relationship of soil constituents | 1 |
| 3 | Calculation of water quantities | 1 |
| 4 | Measurement of matric suction by field tensiometer | 1 |
| 5 | Observation of capillary phenomena of soil-water movement | 1 |
| 6 | Analysis of aggregate stability | 1 |
| 7 | Demonstration of different kinds of maps (soil map, topographic map, landuse map, land system map, cadastral map, air-photo, geological map, vegetation map and satellite imagery) in the lab | 1 |
| 8 | Demonstration and explanation of maps of different scales on how scale affects the land features for study and agricultural planning | 1 |
| 9 | Observation of morphological properties of soils in the field | 1 |
| 10 | Description of soil profiles under distinctive landscapes and land-uses around the university and soil sampling for lab analysis | 1 |
| 11 | Study of soil profiles near the riverside to observe the types of bedrocks and soil forming minerals found in the area | 1 |
| 12 | Interpretation of soil profile data for soil classification and appropriate land-uses | 1 |
| 13 | Introduction to modern tool of soil survey and mapping, viz., global position systems | 1 |
| 14 | Introduction to modern tool of soil survey and mapping, viz., geographic information systems | 1 |
| 15 | Introduction to modern tools of soil survey and mapping, viz., remote sensing using satellite imagery, ground-penetrating radar | 1 |
| | Total | 15 |

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Code No: HRT 213

Course Title: Plantation and Spices Crop Production

Credits: 1+1

Nature of Course: Theory + Practical

Teaching hours: 15 +30

Objectives: Upon the completion of course, the student will gain the knowledge and skill in production and processing technology of important plantation and spice crops of Nepal

Course Contents

A. Theory (15 Hrs)

Unit 1. Introduction: Definition, history, important and scope: area, production and trade status of tea, coffee, cardamom, zinger and other spices, government policy; institutions for promotion of plantation and spices in Nepal. **2 Hrs.**

Unit 2. Agro-technology of tea: botany, soil and climatic requirement, site selection and preparation of land, planting, fertilization, irrigation, different propagation techniques with their merits and demerits; training and pruning, thinning, important insect pests, diseases and their control measures; physiological problems and preventive measures; harvesting, handling and transportation. **3 Hrs**

Unit 3. Agro-technology of coffee: botany, soil and climatic requirement, site selection and preparation of land, planting, fertilization, irrigation, different propagation techniques with their merits and demerits; training and pruning, important insect pests, diseases and their control measures; physiological problems and preventive measures; harvesting, handling and transportation. **2 Hrs**

Unit 4. Agro-technology of rubber: Importance, scope, and production of rubber. **2 Hrs**

Unit 5. Agro technology of spices: cultivation practices of zinger, cardamom, turmeric, saffron, coriander, fenugreek, fennel, cumin, coriander and leaf curry; important diseases, harmful insect, and pests and their control measures; physiological problems and preventive measures; and management of crops **4 Hrs.**

Unit 6. Processing technology: Processing technology and preparation of various tea products: processing for CTC tea, orthodox tea and green tea; processing technology of coffee, cardamom, and zinger; grading, packaging and labeling of end products. **2 Hrs.**

B. Practical (30 Hrs)

(i) Selection of land and layout, digging of pit, application of nutrients and filling of pit (2). (ii) Planting of sapling or planting material (2). (iii) Practices on various methods of asexual method of propagation: techniques of tea, coffee, cardamom, zinger and areca nut (5). (iv) Field visits for identification of disease, insect pest and physiological problems (4). (v) Seed production, drying and seed selection of coffee (1). (vi) Harvesting of tea and coffee (2). (vii) Harvesting of cardamom (1). (viii) Curing of cardamom (1). (ix) Processing and preparation green tea, CTC tea and orthodox tea (3). (x) Processing of coffee (1). (xi) Visit to tea processing industry (4). (xii) Organoleptic test and evaluation of quality (2). (xiii) Field report writing (2).



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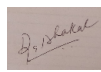
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Code No: ANS 213

Course Title: Pig and Poultry Management

Credits: 1+1

Nature of Course: Theory + Practical

Teaching hours: 15 +30

Objectives: Upon the completion of course, the student will gain the knowledge and skill in management of pig and poultry production

Course Contents

A. Theory (15 Hrs)

Unit 1. Introduction: importance, scope and statistics of pig and poultry (1)

Unit 2. Breed characteristic of pig: landrace, Yorkshire, Tamworth, Durock (1)

Unit 3. Management: housing system and housing materials for swine, care and management of pregnant sow, breeding boar and new born pig (3)

Unit 4. Breed and housing: breeds and breed characteristics of layers, broiler and dual purpose; housing and housing materials, design of poultry housing (2)

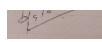
Unit 5. Brooding: natural and artificial; egg formation, selection of eggs for table and incubation purposes, factors essential for best hatching (3)

Unit 6. Management practices for layers and broiler production (3)

Unit 7. Diseases and bio-security of commercial poultry farm (2)


B. Theory (30 Hrs)

| SN | Exercise | No of exercise |
|----|---|----------------|
| 1 | Identification and description of different breeds of pig | 1 |
| 2 | Tagging and ear notching of swine | 1 |
| 3 | Housing and feeding of swine | 1 |
| 4 | Castration, iron administration and vaccination of swine | 2 |
| 5 | Identification and description of layers and broilers | 2 |
| 6 | Identification marking in poultry | 1 |
| 7 | Identification of diseases, vaccination and control of diseases | 2 |
| 8 | Debeaking, candling, grading and selection of eggs | 2 |
| 9 | Feeding and watering of poultry | 2 |
| 10 | Visit to nearby commercial poultry farm | 1 |



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
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Dr. Ishakal

Semester II

| Course Code | Title of Course | Credit |
|-------------|--|---------|
| AQU 220 | Aquaculture | 2+1 |
| ANS 224 | Animal Nutrition and Feeding Practices | 2+1 |
| PLB 222 | Principles and Practices of Plant Breeding | 2+1 |
| HRT 224 | Vegetable Crop Production | 2+1 |
| ECN 222 | Farm Management and Production Economics | 2+1 |
| ENR 221 | Farm Power and Machinery | 1+1 |
| AGR 223 | Grain Legumes, Oil Seed and industrial Crops | 2+1 |
| ENS 221 | Agriculture Meteorology and Climate Change | 2+0 |
| | Total | 15+7=22 |



Code No: AQU 220

Course Title: Aquaculture

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: Upon the completion of the course, the students will be able to gain the basic knowledge and skill in fish cultivated fish production

A. Theory (30 Hrs)

Unit 1. Introduction: definition of fish, fishery and aquaculture; general characteristics of fish, desirable characters of fish for culture; importance and scope, historical of fish development in Nepal. 3 Hrs

Unit 2. Biology of cultivated fish species: morphological characters, feeding habits, growth rate and reproductive behavior of common carp, Chinese carp, indigenous major carp, Tilapia, Trout, Catfishes, Sahar, Silver carp and Freshwater prawns. 5 Hrs

Unit 3. Water quality management: physical (temperature and turbidity), chemical (DO and pH) and biological (plankton) parameters of water. 4 Hrs

Unit 4. Pond management: site selection for pond construction, liming, fertilization, feeds and feeding, role of plankton in fish production, aquatic weeds and predators. 3 Hrs

Unit 5. Fish farming systems: introduction, classification of fish farming system based on intensity, enclosure, fish species and integration. 4 Hrs

Unit 6. Fish breeding: basic principles of fish breeding, breeding of common carp, Chinese carp, and indigenous Major carp, fish seed rearing and transportation. 4 Hrs

Unit 7. Fish net and its uses. 2 Hrs

Unit 8. Fish diseases and parasites: introduction, causal organism, symptoms, and control measures. 5 Hrs

B. Practicals (30 Hrs)

1. Visit of fish farm (1)
2. Identification and description of fish species in Nepal (1)
3. Morphology of cultivated fish of Nepal (1)
4. Anatomy of fish (1)
5. Pond types and measurement of typical pond (1)
6. Pond liming and fertilization (1)
7. Water sampling and identification of planktonic organism (1)
8. Determination of pH of water, dissolved oxygen and turbidity of water (2)
9. Feed formulation and feeding (1)
10. Study of fish breeding (2)
11. Study of fishing gear and pond netting (1)
12. Study of behavioral signs related to fish diseases (2)

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
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Dr. Ishwari

Code No: ANS 224

Course Title: Animal Nutrition and Feeding Practices

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: Upon the completion of the course the students will be able to explain the functions, deficiency symptoms of nutrients and feeding of farm animals

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: terminologies, importance, feedstuff classification; comparative composition of plant and animal cells and tissues. 4 Hrs

Unit 2. Carbohydrate: classification, functions and deficiency symptoms of carbohydrates, digestion of carbohydrates in ruminants and non-ruminants. 4 Hrs

Unit 3. Protein: classification, functions and deficiency symptoms of proteins; digestion of proteins in ruminants and non-ruminants. 4 Hrs

Unit 4. Lipids: classification, functions and deficiency symptoms of lipids; digestion of lipids in ruminants and non-ruminants. 4 Hrs

Unit 5. Minerals: classification, functions and deficiency symptoms of minerals. 2 Hrs

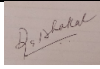
Unit 6. Vitamins: classification, function and deficiency symptoms of vitamins. 2 Hrs

Unit 5. Metabolism and absorption of nutrients in animals; importance and methods of proximate analysis 4 Hrs

Unit 6. Feeding standards for buffalos, cattle, sheep, goat, swine and poultry. 3 Hrs

Unit 7. Feeding of large ruminants (buffalos and cattle), small ruminants (sheep goat), swine and poultry 3 Hrs

B. Practical (30 Hrs)

| SN | Topics | Practical |
|----|---|---|
| 1 | Identification of feed ingredients | 1 |
| 2 | Sampling of feed ingredients for chemical analysis | 1 |
| 3 | Preparation of standard solution for proximate analysis | 2 |
| 4 | Proximate analysis of feed ingredients | 2 |
| 5 | Determination of crude protein | 2 |
| 6 | Determination of NDF and ADF | 2 |
| 7 | Computation of feeds for buffalo and cattle | 1 |
| 8 | Computation of feeds for sheep and goat | 1 |
| 9 | Computation of feeds for swine | 1 |
| 10 | Computation of feeds for poultry (layers and broilers) |  |

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Code No: PLB 222

Course Title: Principles and Practices of Plant Breeding

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: Upon the completion of the course, students will be able to understand the genetic tools in the improvement of crops.

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: definition, importance, history, achievement and relation to other disciplines; concept of gene pool and center of origin, diversity and its significance; introduction, domestication and conservation of germplasm. 3 Hrs

Unit 2. Pollination: mode of pollination, reproduction, pollination control, self-incompatibility and male sterility; quantitative and qualitative characters; biometrical techniques in plant breeding. 3 Hrs

Unit 3. Selection in self -pollinated crops: pure line theory, progeny test, origin of variation, genetic gain and heritability. 2 Hrs

Unit 4. Selection in cross-pollinated crops: genetic composition, Hardy Weinberg law and equilibrium, factor affecting equilibrium, and mating system; selection response and gain from selection in cross pollinated crops. 3 Hrs

Unit 5. Hybridization: definition, objective, types, procedure, and consequences; heterosis and inbreeding. 3 Hrs

Unit 6. Breeding methods: (i) breeding methods in self-pollinated crops: mass selection, pure line selection and pedigree selection; back cross selection, bulk selection, and single seed descent selection; (ii) breeding methods in cross pollinated crops: mass selection, progeny selection, half sib and full sib selection; simple recurrent selection, and selfed progeny selection; (iii) breeding methods in asexually propagated plants: clonal selection. 6 Hrs

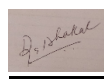
Unit 7. Mutation breeding: definition, types of mutagens, mutation breeding, procedure and its implication. 2 Hrs

Unit 8. Polyploidy breeding: definition of related terms, production and application of haploids, aneuploids, autotriploids and allopolyploids. 2 Hrs

Unit 9. Ideotype breeding: meaning of ideotype breeding, breeding for disease and insect pest resistance; participatory breeding, release of new variety (evaluation, identification and release); and intellectual property right. 3 Hrs

Unit 10. Crop improvement of some important crops of Nepal: rice, wheat, maize, legumes, tomato and potato. 3 Hrs

B. Practical (30 Hrs)

| SN | Topic | Practical |
|----|--|---|
| 1 | Study and draw a floral diagram of self- pollinated field crops | 1 |
| 2 | Study and draw a floral diagram of cross- pollinated field crops | 1 |
| 3 | Estimation of heterosis and inbreeding depression |  |

| | | |
|----|---|---|
| 4 | Estimation of hereditability and genetic gain from selection | 1 |
| 5 | Plant breeding data recording | 1 |
| 6 | Scoring data and determining resistance/susceptibility of insect pest | 1 |
| 7 | Determination of physical and genetic purity in laboratory | 1 |
| 8 | Hybridization technique of self- pollinated crops | 1 |
| 9 | Hybridization technique of cross- pollinated crops | 1 |
| 10 | Hybrid seed production using CMS and self- incompatible lines | 1 |
| 11 | Describing the traits for releasing a new variety | 1 |
| 12 | Visit and study the rice, wheat, maize, and legume breeding activities at NARC Station and participatory breeding program at farmer field | 4 |

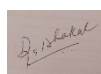
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Code No: HRT 224

Course Title: Vegetable Crop Production

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: Upon the completion of the course the students will develop the knowledge and skills in vegetable production and management

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: nutritional and economic importance, area, production, current trade status, export potentials, classification of vegetable based on botany, climate, season, and part used. 3 Hrs

Unit 2. Production technology of Cole crops and leafy vegetables: cauliflower, broccoli, cabbage, Brussel's sprout, broad leaf mustard, spinach and lettuce 4 Hrs

Unit 3. Production technology of root crops: potato, radish, carrot, sweet potato and beet root. 4 Hrs

Unit 4. Production technology of fruit vegetable: tomato, eggplant, chilly, okra, cucumber, pointed gourd, bitter gourd, pumpkin, sponge gourd, bottle gourd, and water melon. 6 hrs

Unit 5. Production technology of bulb crops: onion and garlic. 2 hrs

Unit 6. Production technology of legume vegetables: beans, cowpeas and peas. 2 Hrs

Unit 7. Minor vegetables: Introduction, importance and scope of asparagus, drumstick, yam, chayote, taro and amaranths. 3 Hrs

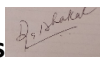
Unit 8. Off season production of vegetables: importance, scope; principles and practices of off season production of vegetables. 3 Hrs

Unit 9. Physiological disorders and post-harvest handling: causes, factors and remedial measures of important physiological disorders of major vegetable crops; post-harvest handling including harvesting, grading, cleaning, packaging, storage and marketing of these vegetables. 3 Hrs

B. Practical (30 Hrs)

Identification and description of varieties/hybrids; nursery preparation and management, preparation of field, sowing/ transplanting; fertilizer applications and intercultural operations, Identification of pests and diseases, identification of physiological disorders and their corrections; post harvesting handling; cost of cultivation and field visit to commercial farms.

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Code No: ECN 222

Course Title: Farm Management and Production Economics

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: Upon completion of this course, the students will be able to describe the various aspects of farm management and the effective ways of managing the farming business for obtaining the optimum farm income.

Course contents

A. Theory (30 hours)

Unit 1: Introduction to Farm Management: definition, scope and importance of farm management, relationship of farm management with other sciences, farm management decisions, factors to be considered in selecting a farm/enterprise (3 hrs)

Unit 2: Production economics: concept of agricultural production economics, production function, law of variable proportions, stages of production, optimum point of production, Cobb Douglas production function (4 hrs)

Unit 3: Production relationships: factor-product relationship, factor-factor relationship, product-product relationship (3 hrs)

Unit 4: Basic principles in farm management decisions: principle of diminishing returns, principle of factor substitution, principle of product substitution, cost principle, principle of opportunity cost, principle of comparative advantage, principle of competitive advantage, principle of equi-marginal returns, time comparison principle (time value of money) (4 hrs)

Unit 5: Farm resource management: land, labor, capital and equipment management (2 hrs)

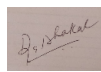
Unit 6: Farm planning and farm budgeting: definition and importance of farm planning, characteristics of a good farm plan, definition and importance of farm budgeting, types of farm budgeting (2 hrs)

Unit 7: Farm records and accounts: definition and importance of farm records and accounts, types of farm records and accounts (2 hrs)

Unit 8: Balance sheet: assets and liabilities, estimation of net worth; farm inventory; purpose and process of making farm inventory, valuation of farm assets, depreciation and methods of estimating depreciation; income and cash flow statement. (4 hrs)

Unit 9: Farm efficiency measures: net worth analysis, liquidity analysis, solvency analysis, profitability analysis (2 hrs)

Unit 10: Linear programming: definition, assumptions, and elements of linear programming, application of linear programming; risk and uncertainty in agriculture: sources of agricultural risk, risk management strategies. (4 hrs)

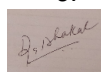


B. Practical exercise (30 hours)

| S.N. | Exercise (Topic of practical) | Number of practical |
|------|---|---------------------|
| 1 | Production function: estimation of the optimum point of production, factor-product relationship | 1 |
| 2 | Estimation of the least cost combination of two inputs | 1 |
| 3 | Determination of the optimum combination of two enterprises for revenue maximization | 1 |
| 4 | Time value of money | 1 |
| 5 | Opportunity cost principle | 1 |
| 6 | Breakeven point (BEP) estimation | 1 |
| 7 | Preparation of a farm plan | 1 |
| 8 | Depreciation | 1 |
| 9 | Farm inventory preparation | 1 |
| 10 | Balance sheet | 1 |
| 11 | Enterprise budgeting | 1 |
| 12 | Income statement | 1 |
| 13 | Application of linear programming model | 1 |
| 14 | Visit to nearby farms and discussion on the current issues in farm management | 2 |
| | Total | 15 |

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1. Shankhyan, P.L. 1983. Introduction to Farm Management. Tata. McGraw-Hill, Co Ltd. New Delhi.
2. Johl, S.S. and T.R. Kapoor. 2009. Fundamentals of Farm Business Management. Kalyani Publishers, New Delhi.
3. Kay, RD. and W M. Edwards 1994. Farm Management. McGraw Hill, Inc., New Delhi.
4. S.C. Panda, S.C. 2007. Farm Management and Agricultural Marketing. Kalyani Publishers, New Delhi
5. Ghimire D.P. and P.P. Regmi. 1991. Laboratory Manual for Farm Management. TU/IAAS, Rampur, Chitwan, Nepal.
6. Panda, S.C. 2007. Farm Management and Agricultural Marketing, Kalyani Publishers, New Delhi.



Code No: ENR 221

Course Title: Farm Power and Machinery

Credits: 1+1

Nature of Course: Theory + Practical

Teaching hours: 15+30

Objectives: Upon the completion of the course, the students will be able to gain the basic knowledge and skill in sources of farm power and their effective utilization in crop production.

Course Contents

A. Theory (15 Hrs)

Unit 1. Mechanization of agriculture: scope and limitation of mechanization in Nepal, sources of farm power – human, animal, mechanical, electrical, wind, solar, micro-hydro, bio-gas; energy demand and supply situation in Nepalese agriculture, utilization of energy source in Nepal; (2 Hrs)

Unit 2. Internal combustion engine: classification and working principles of two-stroke and four stroke cycle compression ignition (diesel) and spark ignition (petrol) engines; components of internal combustion engines and their functions; system in two wheel and four wheel tractor engine-air cleaning, cooling ,fuel supply, lubrication and electrical systems; care, maintenance and trouble shooting of engines; (2 Hrs)

Unit 3. Farm tractor and their management: types, control system on tractor-power transmission, clutch and brake, steering, power take off, differential, hydraulic and hitch system and suitability of tractor for Nepalese agriculture; (2 Hrs)

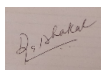
Unit 4. Tillage and tillage implement: definition and object of tillage, conservation verses conventional tillage, indigenous tillage implement used in Nepal; primary tillage implement-mould board plow, disc plow and their components, secondary tillage implements-harrow, cultivator, rotary tillers and rotavator; operation of animal drawn disc harrow, spike tooth harrows; other tillage implements and tools-chisel plow, sub-soiler, ridger, bund former, puddler and leveler; (2 Hrs)

Unit 5. Sowing and planting machines: types of seeding and planting machines, metering mechanism for seed cum fertilizer driller and planter, types of furrow openers for driller and planter, planting machines for potato and, rice; (2 Hrs)

Unit 6. Plant protection equipment: types and working principles of sprayers and dusters, safe handling, selection of nozzles and care and maintenance of sprayers and dusters; (1 Hrs)

Unit 7. Harvesting machines: indigenous harvesting tools, working principles and components of reaper, mower, and combined harvester, harvesting tools for root and tuber crops. Threshing and processing machines: types of thresher, their construction and working principles, factor affecting thresher performance, maize and rice threshers; (2 Hrs)

Unit 9. Farm electricity and electrical machines: traditional water lifting devices, water lifting pumps and electric motors, working principles, care and maintenance of pumps and electric motors. Testing and evaluation of farm machines: field efficiency and cost of tractor and implements. (2 Hr)



B. Practcal 15 (30 Hrs)

1. Identification of workshop tools and equipment -1
2. Identification of internal combustion engine components-1
3. Study of indigenous tillage tools-1
4. Study of mould board, disc plow and disc harrow – 1
5. Study and use of rotary tiller and rotavator-1
6. Practices in seed drill, and planters, zero till drill and seed calibration-1
7. Study of rice drum seeder and transplanter -1
8. Hands on knap-sack sprayer their operation-1
9. Hands on power operated mower and reaper-2
10. Study of Maize Sheller and paddy or multi crop threshers-1
11. Study of external tractor components and control 2
12. Study of power tiller control -1
13. Tractor and power tiller operation -2

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Code No: AGR 223

Course Title: Grain Legumes, Oilseed and Industrial Crops

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: Upon the completion of the course, the students will be able understand major constraints, opportunities and improved cultivation practices of grain legumes, oilseed and industrial crops production in Nepal

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction to grain legumes: Introduction, importance, place in cropping system, human and animal nutrition, area, production, productivity, distribution, major constraints and opportunities of grain legumes and oilseed production in Nepal; 2 Hrs

Unit 2. Cultivation practices: origin, morphology, climatic and soil requirements, improved varieties, cultivation practices, major diseases and pests, threshing, drying and storage of the following crops:

2.1 Chickpea 2 Hrs

2.2 Lentil, 1 Hr.

2.3 Pigeon pea, 1 Hr.

2.4 Black and green grams, 2 Hrs.

2.5 Soybean, 1Hr.

2.6 Field beans including Rajama, lima, pole and Jumli bean. 2Hrs.

Unit 3. Introduction of oil seed crops: Introduction, importance, place in cropping system, human and animal nutrition, area, production, productivity, distribution, major constraints and opportunities of oilseed production in Nepal; 2 Hr

Unit 4. Cultivation practices: origin, morphology, climatic and soil requirements, improved varieties, cultivation practices, major diseases and pests, threshing, drying and storage of following crops:

4.1 Groundnut 2 Hrs.

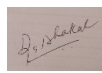
4.2 Rape and mustard 2 Hrs.

4.3 Sunflower 1 Hr.

4.4 Niger 1 Hr.

4.5 Sesame 1 Hr.

4.6 Linseed 1 Hr.



Unit 5. Industrial crops: Introduction, importance, trade, area, production, productivity, distribution, major constraints and opportunities of sugarcane, tobacco, jute and cotton production in Nepal; origin, morphology, climatic and soil requirements, improved varieties, cultivation practices, major diseases and pests of following crops:

5.1 Sugarcane 2 Hrs.


5.2 Tobacco 2 Hrs.

5.3 Cotton 2 Hrs.

5.4 Jute 1 Hrs.

Unit 4. Minor crops: introduction, importance and improvement of minor oil seeds and grain legumes of Nepal. 2 Hr

B.Practical (30 Hrs)

| S. N | Topic | Practical |
|------|---|---|
| 1. | Identification of grain legumes, oilseed and industrial crops grown in the farm or nearby farmers field | 1 |
| 2 | Land preparation and planting of seasonal grain legumes/oilseed /sugarcane/tobacco | 2 |
| 3 | Rhizobium inoculation in grain legumes | 1 |
| 4 | Study of root nodules and nodulation behavior of grain legumes | 1 |
| 5 | Visit to farmers field to study grain legumes in cropping system | 1 |
| 6. | Study of cropping intensity and land equivalent ratio, crop equivalent yield inter cropped or mixed cropped with legumes and oilseed crops. | 2 |
| 7. | Practice on numerical exercise of fertilizers and seed rates in legumes, oil seed, and industrial crops | 2 |
| 8. | study of yield attributes and estimation of yield of seasonal legumes, oilseed and industrial crops available in agronomy farm | 1 |
| 9. | Visit to National Grain Legume Research Program,/ Oil Seed Research Program of NARC | 1 |
| 10. | Raising tobacco seedling | 1 |
| | Topping and de-suckering in tobacco | 1 |
| 11. | Design and implement the agronomic field research | 1  |

Reference:

Rajbhandari, B.P. and G.D. Bhatta. 2008. *Food Crops: Agro-Ecology and Modern Techniques*. Kathmandu, Nepal. Himalayan Collage of Science of Technology.

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
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Code No: ENS 221

Course Title: Agriculture Meteorology and Climate Change

Credits: 2+0

Nature of Course: Theory

Teaching hours: 30

Objectives: Upon the completion of the course the students will be able understand atmospheric processes that produce weather and climate, elements of weather and climate, their variations and significance in agriculture, agro-climatic modification, climate change and its impact in agriculture.

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: definition of weather, climate and micro climate; climatic classification, climate of Nepal, agro-climatic zones of Nepal; cardinal temperature for major crops; scope and role of climate in agriculture. 3 hrs

Unit 2. Solar radiation: solar radiation, nature and properties of solar radiation, sunshine duration and solar constant, net radiation, distribution of radiation on crop canopy, significance of solar radiation on crop production. 4 hrs.

Unit 3. Atmospheric temperature: diurnal and seasonal variations, measurement, heat balance, heat unit concept, latent and sensible heat transfer in air, heat transfer between leaf surface and adjoining air; soil temperature: diurnal and seasonal variations in soil temperature, significance of air and soil temperature in crop production. 4 hrs

Unit 4. Wind: causes, speed and direction measurements, atmospheric pressure: pressure gradient and isobar, measurement of atmospheric pressure, its significance in agriculture. 2 hrs

Unit 5. Precipitation: forms, measurement of rainfall; soil moisture, significance in crop production. 2hrs

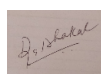
Unit 6. Humidity: concept of saturation and vapour pressure, determinants of humidity, significance of atmospheric humidity in crop production. 2 hrs

Unit 7. Evaporation: factors influencing evaporation and transpiration rates, measurement of evaporation, estimation of actual evapo-transpiration demand of crops; soil-plant- atmosphere continuum. 3hrs

Unit 8. Micro-climate modification: importance and significance of microclimate modification in agriculture, wind modification and shelter-belts. 2 hrs

Unit 9. Weather forecast for agriculture: elements and types of weather forecast- now-casting, very short range forecast (VSRF), short range forecast (SRF), medium range forecast (MRF), long range forecast (LRF), use of remote sensing and geographical information system (GIS) in weather forecasting; importance of weather forecast in crop production. 3 hrs

Unit 10. Climate change: meaning of climate change, global warming, greenhouse effect and other related terminologies, causes of climate change, changes in atmospheric composition, current climate changes and future scenario, its impact on hydrology, agriculture, livestock and biodiversity in Nepal. 5 hrs



References

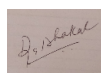
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YEAR III

Semester I

| Course Code | Title of Course | Credit |
|-------------|--|---------|
| HRT 315 | Fruit Crop Production | 2+1 |
| ENR 312 | Farm Water Management | 2+1 |
| STT 310 | Agriculture Statistics | 2+1 |
| AGR 314 | Weed management | 1+1 |
| ENT 313 | Integrated Pest Management | 2+1 |
| ECN 313 | Agriculture Marketing and Cooperatives | 2+1 |
| ECN 314 | Entrepreneurship Development | 2+1 |
| PLB 313 | Plant Biotechnology and Biodiversity | 2+1 |
| | Total | 15+8=23 |



Code No: HRT 315

Course Title: Fruit Crop Production

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: Upon the completion of the course the students will be able to explain the basic principles and practices of fruit crops cultivation

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: importance and scope; fruit zone of Nepal; area, production, demand and supply; export potential; history of fruit development in Nepal. **3 Hrs**

Unit 2. Production techniques of tropical and subtropical fruits: cultivation practices including area, production, soil and climatic requirement, varieties, propagation, fertilization, irrigation, insect pest and diseases, and harvesting of mango, banana, citrus (mandarin, sweet orange, lime, lemon), guava, pomegranate, papaya, pineapple, jackfruit, avocado, litchi, kiwi, and strawberry. **12 Hrs**

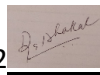
Unit 3 Production techniques of temperate fruits: good cultivation practices including area, production, soil and climatic requirement, varieties, training and pruning, propagation, fertilization, irrigation, insect pest and disease and harvesting of apple, pears, walnut, peach, plum, almond, cherry, apricot, and grape. **8 Hrs**

Unit 4. Special production problems and their management: causes, symptoms, and their control measures in mango, citrus, banana and apple. **3 Hrs**

Unit 5. Minor fruit crops: importance, characters and adaptation, production and utilization of minor fruit crops: fig, ber, sapota, olive, jamun, blueberry, blackberry, cranberry, chestnut, hazelnut and pecan nut. **2 Hrs**

Unit 6. Postharvest handling of fruit crops: grading, packaging, pre-cooling and storage of fruit crops. **2 Hrs**

B. Practical (30 Hrs)

| SN | Topics | Practical |
|----|---|---|
| 1 | Identification and brief description of varieties of fruit crops | 2 |
| 2 | Orchard lay out and planting of fruit crops | 2 |
| 3 | Training and pruning of various fruit crops | 2 |
| 4 | Desuckering in banana | 1 |
| 5 | Application of manures and fertilizers in fruit trees | 1 |
| 6 | Preparation and application of PGRs in fruit crops. | 1 |
| 7 | Preparation and application of pesticide and fungicide in fruit crops | 2 |
| 8 | Maturity judgment, harvesting and storage of fruit crops. | 2  |

| | | |
|----|--|---|
| 9 | Visit to commercial orchards and diagnosis of maladies | 1 |
| 10 | Budget estimation of establishing orchard | 1 |

References

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Code No: ENR 312

Course Title: Farm Water Management

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: upon the completion of the course, the student will develop knowledge and skill on basic principles and practices of irrigation and drainage, soil-water-plant relationship, water requirement, irrigation methods, scheduling irrigation and irrigation systems in Nepal

Course Contents

A. Theory (15 Hrs)

Unit 1: Introduction: concept of irrigation and drainage, definition and objectives of irrigation, Importance of irrigation in crop production; climatic condition and need for irrigation, water resource potential in Nepal, and environmental consequences of irrigation 2 hrs

Unit 2: Irrigation systems: farmer managed irrigation systems in Nepal–indigenous and modern; initiatives for irrigation development in Nepal, major irrigation systems in Nepal; status and performances of irrigation systems in Nepal, 3hrs

Unit 3. Water relation: soil-water-plant relationship, physical properties of soil in relation to irrigation, soil moisture constant, soil water retention and movement, soil moisture regimes and their responses to crops, rooting characteristics and soil moisture extraction pattern and critical stages of crops for irrigation, moisture stress, types of field moisture losses 4hrs

Unit 4. Potential evapo-transpiration (PET): concept of evaporation, transpiration, evapo-transpiration, consumptive use, potential evapo-transpiration, crop coefficient, seasonal ET, actual ET, estimated ET by field and empirical methods, effective rainfall, crop period, 3hrs

Unit 5. Crop water requirement: determination of crop water requirement- transpiration ratio method, depth-interval yield method, soil moisture depletion method, climatological method, field experiment method and drum culture methods evapo-transpiration, 3hrs

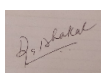
Unit 6. Irrigation scheduling: objective and strategies of irrigation scheduling, function of irrigation water, limiting soil moisture condition, depth and frequency of irrigation, deficit irrigation, allowances soil moisture depletion, soil, plant and climatic indicators for irrigation scheduling, 3 hrs

Unit 7. Irrigation methods: surface method-check basin, border strip, contour lateral, ring basin, furrow, corrugation; sub-surface methods-drip, trickles; overhead methods-sprinkler and green house and landscape irrigations – fertigation; water use efficiency , quality of irrigation water 4hrs

Unit 8. Utilization of ground water: water lifting devices – pumps (shallow and deep well), capacity, power calculations, Irrigation water measurement – weirs, flumes and orifices and methods of water measurement and instruments, water conveyance systems, open channel and underground pipeline, 4hrs

Unit 9. Drainage system: water logging and its effect; causes of water logging, land drainage, classification of drainage, benefits of drainage; essential requirement of drain, surface drain and close drain. 2hrs

Unit 10. Rain harvest: importance, principles and practices of rainfed agriculture; rain harvest methods, soil moisture conservation in Nepal. 2 hrs



Practical 15 (30 hours)

1. Measurement of soil moisture: Gravimetric, Tensiometer, Feel and Appearance and soil moisture meter methods 2
2. Determination of soil moisture constant: Saturation Capacity (SC), Field Capacity (FC), Permanent Wilting Point (PWP) and Ultimate Wilting (UW) 2
3. Measurement of infiltration rate of soil: use of double ring infiltrometer, single ring infiltrometer, 1
4. Determination of evapotranspiration by using climatic data: use of Penman's Method, use of Blaney-Criddle Method, Using pan evapometer, lysimeter 2
5. Study of different irrigation methods for horticultural crops: 2
6. Determination of field water losses, seepage, run-off and percolation 1
7. Measurement of flow of water in open channel by using float method, flow measuring devices-weirs, Parshall flume, cutthroat flume and orifices 1
8. Design and layout of micro irrigation systems for different horticultural crops 1
9. Developing fertigation schedule for crops 1.
10. Design and layout of farm ponds 1
11. Field visit to drip and irrigation system 1

References

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Code No: STT 310

Course Title: Agriculture Statistics

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: Upon the completion of the course the students will be able to design experiment, collect, tabulate and analyze data, and prepare the scientific report.

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: definition, use in agriculture, and limitation. 1 Hr

Unit 2. Population and samples: definition of population, sample, characteristics of good samples; sampling methods- simple random sampling, samples selection from agriculture field by simple random samples, probability proportional to size, stratified random sampling, systematic sampling, cluster sampling, multistage sampling and sampling error. 2 hrs

Unit 3. Measures of central tendency: definition of arithmetic mean, median and mode, merits, demerits and uses of measure of central tendency; properties of ideal measure of central tendency, partition values- quartiles, deciles and percentage. 2 Hrs

Unit 4. Frequency distribution: presentation and summarization of data by different classification methods- exclusive, inclusive; diagrammatic- bar and pie; graphical- histogram, frequency polygon, frequency curve. 2 Hrs

Unit 5. Measures of dispersion: range, quartile deviation, mean deviation, standard deviation, variance and coefficient of variation, moment- measures of skewness and kurtosis. 2 Hrs

Unit 6. Probability: concept of probability, definition of random experiment, sample space, event- dependent, independent, trail, mutually exclusive and exhaustive events, equally likely events, simple and compound events; definition of probability, simple problem based on probability; addition and multiplication theorems, conditional probability. Probability distribution: binomial distribution and its properties and problems, poisson distribution and its properties, normal distribution with its properties and problems; sampling distribution of means and differences. 4 Hrs

Unit 7. Correlation: definition and types of correlation, scatter diagrams, Karl Pearson's coefficient of correlation (linear correlation). 2 Hrs

Unit 8. Regression: meaning of regression, regression equations of Y on X and X on Y, relation between correlation coefficient and regression coefficient. 2 Hr

Unit 9. Test of significance: introduction, definition of hypothesis, null and alternative hypothesis; degree of freedom, level of significance, types of error, significance of mean- one sample and two sample means of large samples (Z-test); significance of means in small samples (t-test)- one sample, two samples and two related sample mean test (pair test), test for correlation coefficient F- test, χ^2 (chi square) test for independent and goodness of fit. 4 Hrs

Unit 10. Principles of field experiment: plot experiment- replication, randomization, local control, one way analysis of variance (CRD), two ways analysis of variance (RBD), three ways analysis of variance (Latin Square Design) and factorial experiment 2^2 and 2^3 . 9 Hrs

B. Practical (30 Hrs)

| SN | Topic | Practical |
|----|---|-----------|
| 1 | Measures of central tendency of grouped and ungrouped data | 1 |
| 2 | Classification of data by exclusive and inclusive methods, diagrammatic presentation of data by Bar and Pie chart | 1 |
| 3 | Cumulative frequency table from raw data and its graphical presentation by histogram, frequency polygon, frequency curve ogives. | 1 |
| 4 | Measures of dispersion of ungrouped and grouped data | 1 |
| 5 | Measures of skewness and kurtosis | 1 |
| 6 | Simple problems on probability and probability distribution | 2 |
| 7 | Computation of correlation coefficient and regression coefficient of Y on X and X on Y | 1 |
| 8 | Test of significance of means in large samples (Z-test: one sample and two sample means test) | 1 |
| 9 | Test of significance of means in small samples (t-test: one sample and two sample means, and two related samples test pair t- test) | 1 |
| 10 | Test of equality of two population variance (F-test) | 1 |
| 11 | Test of independent and goodness of fit (Chi square test) | 1 |
| 12 | Analysis of variance (ANOVA) of CRD, RCBD and Latin Square | 2 |
| 13 | Factorial experiment 2^2 and 2^3 | 1 |

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Chandel, S. R. S. 1984. A Hand Book of Agricultural Statistics. Achal Prakashan Mandir, Kanpur, India

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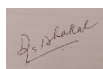
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Krishnaswami O.R. 1993. *Methodology of Research in Social Sciences*. Himalaya publishing House, Bombay, India.

Laake P., Benestad H.B. and Olsen B.R. 2007. *Research Methodology in the Medical and Biological Sciences*. Academic Press, CA, USA.

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Code No: 314

Course Title: Weed Management

Credits: 1+1

Nature of Course: Theory + Practical

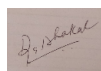
Teaching hours: 1 5 +30

Objectives: Upon the completion of this course, the students will be able to develop knowledge and skill in weeds and their management in various field crops.

Course Content

A. Theory (15 hrs)

- Unit 1. Introduction to weeds:** Definition and classification of weed; Economic importance of weeds; losses caused by weeds, beneficial effect of weeds, and weed ecology. 2 hrs
- Unit 2. Characteristics of weeds:** Dormancy, viability and germination; growth habit; reproduction and multiplication; persistence and tolerance/resistance. 1hr
- Unit 2. Crop - weed competition:** Crop-weed interference and general principles; different factors of competition. Factors affecting crop weed competition; critical period and thresholds of crop weed competition. 2 hrs
- Unit 3. Weed management:** Concept of weed control, prevention, eradication, control and management; principles and practices of preventive measure of weed management. 2 hrs
- Unit 4: Weed control methods:** Physical, cultural, biological, chemical, biotechnological, and integrated weed management. 4 hrs
- Unit 5. Herbicides:** Definition; characteristics of ideal herbicides; usefulness and limitation of herbicides, classification of herbicides: based on time of application, selectivity, site of application, mode of action of herbicides, herbicides and environment. 2 hr
- Unit 6. Weed control in specific crops:** Weed management in direct seeded rice, transplanted rice, maize, and wheat. 2hrs




B. Practical (30 Hrs)

| S.N. | Topic | No. of Practical |
|--------------|--|------------------|
| 1. | Identification of major weeds of field crops | 1 |
| 2. | Survey of weeds in crop fields and other habitats | 2 |
| 3. | Determining critical period of crop weed competition | 1 |
| 4. | Herbarium preparation of weeds | 2 |
| 5. | Estimation of weed density, weed control efficiency and weed index | 2 |
| 6. | Weed control of field crops | 2 |
| 7. | Study of commonly available herbicides in the market, their nomenclature and label information | 1 |
| 8. | Calculation of herbicides requirement for different formulation | 2 |
| 9. | Study of herbicide application equipment and calibration | 1 |
| 10. | Herbicide application methods and precautionary measures | 1 |
| Total | | 15 |

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5. Subramanian, S., Mohammed Ali, A. and Jayakumar, R. (1991). *All About Weed Control*. Ludhiana: Kalyani Publishers
6. Tadulingam, C. and Venkatnarayana, D. (1955). *A Handbook of Some South Indian Weeds*. Madras: Government Press
7. Thakur, C. (1977). *Weed Science*. New Delhi: Metropolitan Book Co. Pvt. Ltd.



Code No: ENT 313

Course Title: Integrated Pest Management

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: Upon the completion of the course, the students will be able to explain the various integrated approaches of crop pest management.

Course Contents

A.Theory (30 Hrs)

Unit 1. Basic concept of IPM: concept of pest and IPM, classification of insects; terminologies related to IPM-insect pest management, integrated pest management, organic pest management; general impact of pest; factors responsible for pest outbreak, history of pest management, history of IPM and development of IPM in Nepal. 3 Hrs

Unit 2. IPM tactics and strategies: manipulation of pest, plant and environment. 2 Hrs

Unit 3. Decision level and significance for threshold assessment: (i) decision level assessment tool-monitoring, survey and surveillance; (ii) concept of threshold level for assessment of decision level of pest management; and (iii) significance of decision level in pest management. 3 Hrs

Unit 4. Methods of IPM: principles, practices and significance of (i) cultural, (ii) mechanical, (iii) physical, (iv) biological, and (v) chemical methods of IPM. 5 Hrs

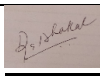
Unit 5. Legislative approaches: concept of quarantine, quarantine in Nepal and its role in pest management, pest risk analysis and its significance, national and international IPM policies 2 Hrs

Unit 5 Pesticides: types of bio-pesticides and history of its development; types, classification, formulation, hazardous level of chemical pesticides, , spray techniques, exposure to pesticide, residue level and management of residue levels, measurement of residues; pollution caused by pesticides, areas of misuse and precautionary measurement, international conventions related to pesticides. 9 Hrs

Unit 6. Host plant resistance: basic concept, history and significance in pest management, mechanism and management techniques of HPR, genetic engineering techniques and its significance in IPM. 3 Hrs

Unit 7. Concept of IPM extension mode: farmer's field school, common IPM tools available in Nepal, innovative control methods and their use in IPM. 3 Hrs

B. Theory (30 Hrs)

| SN | Topics | Practical |
|----|---|---|
| 1 | Identification and description of IPM tools | 1 |
| 2 | Identification of common predators and parasitoids | 1 |
| 3 | Monitoring of pest through pheromone traps | 1 |
| 4 | Monitoring of fruit fly through cure lure trap | 1 |
| 5 | Preparation of botanical bio-pesticides and its application | 1 |
| 6 | Formulation of chemical pesticides and spray techniques in field | 1 |
| 7 | Identification and collection of insect repelling botanical materials |  |

| | | |
|----|--|---|
| 8 | Identification and collection of insect pests, diseases, weeds and natural enemies | 1 |
| 9 | Pesticide survey in market and their classification | 1 |
| 10 | Bioassay techniques of pesticide and bio-pesticide against insect | 1 |
| 11 | Familiarization of bio-pesticides available in market and production technique of Heli-NPV | 1 |
| 12 | Raring of Corcyra for Trichogramma production and releasing technique in maize field | 1 |
| 13 | Assessment of morphological resistance traits of certain crops against insect pest | 1 |
| 14 | Use of rodent management techniques in field and household | 1 |
| 15 | Isolation of EPF from soil and lab study of bio-pesticide focused on Metarhizium | 1 |


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Neupane, F. P. 2002. *Tarkari Barima Lagne Kirahahuko Akikrit Bebasthapan* (In Nepali), Jagadamba Press, Patandhoka, Lalitpur, Nepal

Norris, R. F., E. P. C. Chen and M. Kogan. 2002. Concepts in Integrated Pest Management. Printice- Hall India



Code No: ECN 313

Course Title: Agriculture Marketing and Cooperatives

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: Upon the completion of the course, the students will be able to understand the meaning, concept, scope and importance and functioning of agricultural marketing and cooperatives.

Course Contents

A. Theory (30 hours)

Unit 1: Market and marketing: Concept and meaning of market and marketing, marketing functions, classification of markets, marketing system, importance of agricultural product prices and agricultural marketing, export and import situations of food products in Nepal (4 hrs)

Unit 2: Agricultural marketing: marketing channels, marketing costs, price spread, marketing strategies, market actors, marketing intermediaries, marketable surplus (3 hrs)

Unit 3: Theory of firm: concept of industry and firm, theory and characteristics of firms (2 hrs)

Unit 4: Market structure and price determination: concept of market structure, ways of categorizing market structure, perfect competition market, monopoly market, monopolistic market, oligopoly market (5 hrs)

Unit 5: Price discrimination: concept of price discrimination, types of price discrimination – first degree price discrimination, second degree price discrimination, third degree price discrimination (2 hrs)

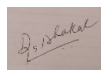
Unit 6: Marketing research: concept of marketing research, market planning, market information system (MIS), factor influencing buyer's behavior, risk in marketing (2 hrs)

Unit 7: Price index: concept of price index, price index for various commodities, trends in price and their analysis; demand supply forecasting, factors and methods of demand and supply forecasting 4 hrs

Unit 8: Government interventions and public institutions in agriculture marketing: public institutions related to agricultural marketing, roles of government and public institutions in agricultural marketing, government regulations for stabilizing prices and farm income (2 hrs)

Unit 9: Cooperatives: concept and meaning of cooperative, cooperative principles, history of cooperative development in Nepal, scope of agriculture cooperatives, organization structure, cooperative farming and marketing, cooperative laws and bylaws (4 hrs)

Unit 10: Concept of free market and liberalization: Introduction to World Trade Organization (WTO) and General Agreement on Tariffs and Trade (GATT) (2 hrs)



B. Practical exercise (30 hours)

| S.N. | Exercise | Practical |
|------|---|-----------|
| 1 | Assessment of Demand-supply of different agri. Commodities in local market | 1 |
| 2 | Estimation of demand and supply curve of different agri. Commodities in local market | 1 |
| 3 | Calculation of marketing margins and producer's shares for various farm-based products | 1 |
| 4 | Estimation of price spread, margin and marketing costs for major/selected farm products | 1 |
| 5 | Preparation of marketing channel of different agri. Commodities of local market | 1 |
| 6 | Calculation of marketing efficiency of agri. Commodities in different marketing channel | 1 |
| 7 | Demand and sales forecasting techniques of agri. Products | 1 |
| 8 | SWOT analysis of major agricultural commodities | 1 |
| 9 | Major government and public institutions working in agricultural marketing in Nepal | 1 |
| 10 | Government interventions in the marketing of food products in Nepal | 1 |
| 11 | Observation on quantities of major agricultural commodities demanded and supplied at the local market | 1 |
| 12 | Visit to the marketing center/agro-processing factory for studying the marketing intermediaries and marketing channels of the selected food products (case study) | 2 |
| 13 | Visit to the selected agriculture cooperatives for studying their organization, management structure, activities, scope and importance in agricultural development in the localities (case study) | 2 |
| | Total | 15 |

Reference books

4. Rhodes, V.J. 1983. The agricultural marketing systems. John. Wiley, and Sons, Inc. Singapore.
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10. Koutsoyiannis, A. K. 1994. Microeconomics, Printice Hall, India.



Code No: ECN 314

Course Title: Entrepreneurship Development

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: The objective of this course is to provide fundamental knowledge on entrepreneurship development and encouraging student to personally develop entrepreneurs. This course attempt to acquaint the students the possibilities of establishing own entrepreneurial venture.

Course Contents

A. Theory (45 Hrs)

Unit 1. Meaning, concept and definitions of entrepreneurship; role of entrepreneurship in the economic development, growth of entrepreneurship development, entrepreneurship development programs in Nepal. 4 Hrs

Unit 2. Concept and definitions of entrepreneur, entrepreneur as a risk bearer, entrepreneur as an organiser, entrepreneur as a innovator; characteristics of entrepreneur, distinction between entrepreneur and a manager, functions of an entrepreneur, types of entrepreneur, concept of women entrepreneur, concept of rural entrepreneurship, need for rural entrepreneurship, problem of rural entrepreneurship, how to develop rural entrepreneurship, globalization and entrepreneurship development.

10 Hrs

Unit 3. Factors affecting entrepreneurial growth – economic factors, non-economic factors, psychological factors, government actions, entrepreneurial motivations, motivations theories: Maslow's need hierarchy theory, Hertzbergs Dual factor theory and McClelland's Need achievement theory.

10 Hrs

Unit 4. Entrepreneurship development programs (EDPs), need of EDPs, objectives of EDPs, phases of EDPs – pre-training phase, training phase and post training phase (follow up), evaluation of EDPs, problems faced by EDPs. 6Hrs

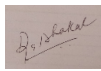
B. Practical (30 Hrs)

Discussions, simulations, case studies and preparation of business plan

References

Khanka S.S. *Entrepreneurship Development*. S. Chand and Publication, New Delhi, India

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Code No: PLB 313

Course Title: Plant Biotechnology and Biodiversity

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: At the end of the course the students will be able to explain the basic concept of biotechnology, principles, techniques, commercial applications of plant tissue and cell culture and micro-propagation of plant

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: definition, history and field of biotechnology; current activities and future scope of

biotechnology in agriculture in Nepal; plant biotechnology: definition, types, relation to other disciplines, future scope of plant biotechnology in Nepal, 2 hrs

Unit 2. Genetic engineering and gene cloning: definition, history, basic steps involved and methods of genetic

engineering; restriction enzymes and its types; gene cloning vectors and methods of gene cloning; application of genetic engineering in agriculture, 3 hrs

Unit 3. Micro-Propagation Technique: Phyto hormones and their role in plant tissue culture, Media preparation,

Axillary buds proliferation, Regeneration through meristem cell culture, callus cultures, organogenesis and somatic embryogenesis; Production, preservation and use of somatic embryos. Protoplast isolation and culture; Cryopreservation and germplasm storage; Micropropagation of horticultural plants; 4 hrs

Unit 4. Tissue and Cell culture Techniques: Essentials of a tissue culture laboratory, Biosafety, Media, Media

preparation, General techniques in tissue culture, Environment for tissue culture, Maintenance of callus, Techniques of Meristem culture and *in vitro* grafting for the production of virus free plants. Pollen/microspore culture for haploid plant production, use of haploids in plant breeding and mutation research. Techniques of Embryo culture and embryo rescue in agricultural and horticultural crops, Endosperm culture; somatic hybridization and production of hybrids. Plant tissue culture as industry, 8 hrs

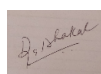
Unit 5. Polymerase chain reaction and gel electrophoresis, 2 hrs

Unit 6. Plant breeding at molecular level: molecular marker technology, marker assisted selection in plant breeding. QTL (Quantitative trait Loci), protoplast fusion; importance of GM plants, testing GM crops, 3 hrs

Unit 7. Biodiversity: introduction, concept and aims biodiversity, importance, scope and factor affecting biodiversity; biological hierarchy of biodiversity (genes-population-species-communities-ecosystem-landscape-biosphere). 2 hrs

Unit 8. Genetic diversity: species and genetic diversity, wild genetic diversity of some important crops; center of diversity of crops; data base, biodiversity indexing. 3 hrs

Unit 9. Germplasm: germplasm collection, concept of conservation, *Ex-situ* and *in-situ* conservation and utilization; risk of extinction and recovery program, national legislation and intellectual property right. 3 hrs



Laboratory Work

Plant Micro-Propagation Techniques (Plant tissue culture)

- Sterilization techniques in plant tissue culture, composition of media and media preparation from stock solutions - 3 lab classes
- Callus culture and growth of callus – 2 lab classes
- Induction of direct and indirect somatic embryogenesis from callus and preparation of synthetic seeds – 2 lab classes
- Micropropagation of plants by axillary bud/ single node culture proliferation 1 lab class
- Isolation of genomic (by CTAB method) and mitochondrial DNA of plants – 2 lab class
- Agrobacterium mediated transformation of tobacco/*Arabidopsis* using leaf disc method and production of transgenic plant. - 3 lab classes
- Molecular biological test of transgenic plants (T_0) by PCR-method Southern blot (Dig-labeling) - 2 lab classes

References

Ignacimuthu, S. 1996. Basic Biotechnology. Tata MacGraw Hill Publishing Co., Ltd, India

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Mascarenhas, A. F. 1997. Hand Book of Plant Tissue Culture. ICAR, New Delhi

Purohit, S.S. (2005). Biotechnogy fundamentals and application. Student edition.

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Adrian, S.N. **Scot N** and Fowler, M. (2003). Plant Biotechnology: The genetic manipulation of plants. Oxford University Press.

Bhattarai, T. (2000). Experimental Plant Biochemistry and Plant Biotechnology (Tissue culture). Bhudipuran Prakashan, Kathmandu.

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
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Ausubel F.M., Brent R., Kingston R.E., Moore D.D., Seidman J.G., Smith J.A., Struhl K (2002). Short Protocols in Molecular Biology. Wiley.



Semester II

| Course Code | Title of Course | Credit |
|-------------|--|----------|
| EXT 323 | Social Mobilization and Community Development | 2+1 |
| ECN 325 | Agribusiness Management | 2+1 |
| AGR 325 | Principles and Practices of Seed Technology | 2+1 |
| ANS 325 | Principles and Practices of Animal Breeding | 2+1 |
| SOS 324 | Soil Conservation and Watershed Management | 2+1 |
| SOS 325 | Remote Sensing and GIS in Agriculture | 1+1 |
| HRT 326 | Post-harvest Management of Horticultural Crops | 2+1 |
| PLP 323 | Plant Clinic | 0+2 |
| | Total | 13+9= 22 |



Code No: EXT 323

Course Title: Social Mobilization and Community Development

Credits: 2+1

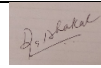
Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: This course will enable the students to select, and apply the most appropriate process, approaches and techniques in developing rural community development programs by appreciating the importance of socially organized groups and their mobilization in the developmental activities. This course will also enable the students to make wise use of gender concepts and issues related to development in most relevant ways.

Course Contents

Theory (30 Hrs)

| SN | Unit-I | No of Lecture |
|----|--|---|
| 1 | Concept of development, sustainable development, rural and community development, principle of community development, a brief overview of efforts and approaches of rural development in Nepal over the last decades | 3 |
| 2 | Factors and goals of development, cultural and social heritage and dilemma in the rural development of Nepal | 2 |
| 3 | Major problems and issues of rural and community development in Nepal. | 2 |
| 4 | Poverty, human poverty, relative deprivation, poverty in SAARC countries, SAARC declaration on poverty Elimination | 3 |
| | Unit-II | |
| 5 | Concept of social mobilization, definition, purposes, strategy of implementing social mobilization, Specification of societal commitments | 3 |
| 6 | Process of social mobilization, institutional development, participatory planning, implementation of plans and sustainable utilization of results | 3 |
| 7 | Social mobilization in multi-ethnic communities and conflict situation | 1 |
| 8 | History of social mobilization in Nepal, lesson learned | 2 |
| 9 | Decentralization for development, definition, strategy and current status of decentralization in Nepal. | 2 |
| 10 | Concept of micro-finance and its role in poverty alleviation; practices of micro-finance in Nepal | 3 |
| 11 | Actors of rural development and poverty alleviation programs, linkages and coordination, problems and issues. | 2 |
| | Unit-III | |
| 12 | Introduction to gender concepts, gender segregation and stratification, discrimination, equity and social inclusion. |  |

| | | |
|----|--|---|
| | | 1 |
| 13 | Gender needs, roles, analysis, gender sensitive planning, gender audit, gender mainstreaming in development in general and poverty in particular with specific focus at the resource poor women. | 2 |
| 14 | Origin and concept of WID, WAD, GAD and GESI | 1 |

B. Practical (30 Hrs)

| SN | Topic | Practical |
|----|--|-----------|
| 1 | Conducting baseline survey into a rural community and analyzing the situation | 2 |
| 2 | Preparing village profile | 2 |
| 3 | Exposure on techniques of organization development through audio visual media, role play and making site visits to observe the real action at the grassroots | 2 |
| 4 | Conducting a participatory social action planning exercise to prepare portfolio of opportunities and community investment plans, aggregation | 2 |
| 5 | Business plan preparation (Livestock, poultry bird and agri. based IG enterprises) | 1 |
| 6 | Observing VDC level planning and process. | 2 |
| 7 | Practical exercise on participatory monitoring and evaluation system | 2 |
| 8 | Practical exercise on exploring equity and inclusion issues and resolving them | 1 |
| 9 | Practical on MIS through observing a real case at the grassroots. | 1 |

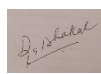
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UNDP. 2001. Governance and poverty reduction: National Human Development Report, Kathmandu

Katar Singh, 1999. Rural Development, second edition, *Sage Publications*, New Delhi. Thousand Oaks. London

Jayanti Barua, 2001. Social Mobilisation and Modern Society, first edition, *A Mittal Publication*, New Delhi



Code No: ECN 325

Course Title: Agribusiness Management

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: The objective of this course is to provide comprehensive knowledge of management principles and techniques on operation management, personnel management, financial management, marketing management, project management and materials management.

Course Contents

A. Theory (30 Hrs)

Unit 1. Agribusiness Management: concept and definition, importance and scope of agribusiness management, economic principles related to agribusiness management **3 Hrs**

Unit 2. Business organization and management: features of organization, management structure and management process, strategic planning and decision making process; payoff matrix and decision tree **4 Hrs**

Unit 3. Leadership and motivation: concept of leadership and motivation, features and types of leadership, factors affecting motivation; Abhrahm Maslow's need-based theory **4 Hrs**

Unit 4. Financial management: concept of financing in agribusiness, inventory, income statement, balance sheet, ratio analysis based on income statement and balance sheet; efficiency and profitability ratio. **3 Hrs**

Unit 5. Investment appraisal: discounted and undiscounted cash flow measures, sensitivity analysis and risk management **4 Hrs**

Unit 6: Business identification and development: situation analysis for business identification (target group, resource, existing market and key constraints), value chain analysis for products, markets and means of marketing. **5 Hrs**

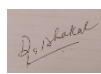
Unit 6. Agribusiness environment: problem and prospect of agribusiness in Nepal, import and export situation of agricultural commodities in Nepal, implications of WTO in agriculture sector, industrial policy, public and private sector partnership in agribusiness development. **4 Hrs**

Unit 7. Business plan: Concept of business plan, content of business plan, procedure for making business plan. **2 Hrs**

Unit 8. Social responsibility: areas of social responsibility and business ethics, arguments for and against social responsibilities. **1 Hrs**

Practical (30 Hrs)

1. Potential product identification for agribusiness development in nearby market
2. Analysis of backward and forward linkages of major agricultural products
3. Organization and management structure in different firm and agro industries
4. Preparation and analysis of balance sheet- a case study
5. Preparation and analysis of profit and loss – a case study
6. Cash flow analysis of agro industries
7. Value chain mapping of major agricultural commodities
8. Investment appraisals through discounted and undiscounted cash flow measures of project worth
9. Visit to agribusiness unit for the analysis of problems, performance and prospects- A case study
10. Preparation of business plan for agricultural firms



References:

Broadway, A.C. and Arif, A.B. 2002. A Text Book of Agribusiness Management. Kalyani Publishers, India


Dahama, O.P. and O.P. Bhatnagar. 1994. Education and Communication for Development. Oxford and IBH Publishing Co Pvt. Ltd., India.

Downey, W. D. and Erickson, S.P. 1987. Agribusiness Management. McGraw Hill Inc.

Koontz, Harold, Daytan and O. Donnel, Cyril; *Principles of Management*. (2010), New edition, Mc. Grawhill Publication.

Poudel, K. L. 2006. Agribusiness Management. Himalayan College of Agricultural Sciences and Technology (HICAST)/Purbanchal University

Rhodes, V. J. 1983. The Agricultural Marketing System. John Wiley, and Sons, Inc. Singapore



Code No: AGR 325

Course Title: Principles and Practices of Seed Technology

Credits: 2+1

Nature of the Course: Theory + Practical

Teaching hours: 30+30

Objectives: Upon the completion of the course the students will be able to gain knowledge and skill in the seed production technology of major field crops and commercial vegetables under Nepalese conditions.

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: seed as basic unit of crop production, importance and scope of seed industry in Nepal, history of field crops and vegetables seed industry in Nepal. **2 Hrs**

Unit 2. Seed development: definition of seed, fruit, grain, and seed materials, seed formation and development, factors affecting seed development; seed dormancy, dormancy breaking and seed germination; factors affecting seed germination. **3 Hrs**

Unit 3. Principles of seed production: selection of seed production area, role of temperature, humidity and light in seed production. **3 Hrs**

Unit 4. Seed production techniques of major field crops: rice, maize, wheat, pulses and oil seed crops **5 Hrs**

Unit 5. Seed production techniques of commercial vegetables: Cole crops, root crops, leafy vegetables, Cucurbitaceous, Solanaceous and bulb crops. **5 Hrs**

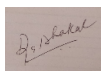
Unit 6. Types of seeds: types of seed and their production. **2 Hrs**

Unit 7. Seed quality: Seed vigor, seed viability and purity analysis; seed longevity and causes of seed deterioration; seed testing: purity, germination and moisture content. **3 Hrs**

Unit 8. Field and seed standards: field inspection, seed extraction, seed cleaning, grading, treatment, drying and packing, labeling and storage. **3 Hrs**

Unit 9. Seed production: participatory seed production of field crops and vegetables. **2 Hrs**

Unit 10. Seed legislation: seed certification and minimum certification standards for foundation and certified seeds; International Seed Testing Association and National seed laws and by-laws. **2 Hrs**

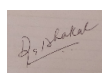


B. Practical (30 Hrs)

| SN | Topics | No of practical |
|----|--|-----------------|
| 1 | Study of seed structure, color size, shape and texture | 1 |
| 2 | Field inspection of seed crops and rouging | 1 |
| 3 | Harvesting and seed extraction, cleaning, drying, treatment, packaging and storage | 3 |
| 4 | Germination and purity analysis | 2 |
| 5 | Seed sampling, testing and labeling | 2 |
| 6 | Methods of seed production in self and cross pollinated crops | 2 |
| 7 | Maturity judging of seeds | 1 |
| 8 | Seed processing by machines | 1 |
| 9 | Visit to seed production units | 1 |
| 10 | Identification of cultivar/ variety and participatory farmers | 1 |

References

- Agrawal P.K. and M. Dadlani 1992. *Techniques in Seed Science and Technology*. South Asian Publ.
- Fageria M.S., P. S. Arya and A. K. Choudhary. 2000. *Vegetable Crops: Breeding and Seed Production*. Vol. I. Kalyani.
- George RAT. 1999. *Vegetable Seed Production*. 2nd edition. CABI. *Developing Hybrids in Vegetable Crops*. Agro Botanical Publ.
- More T.A., P.B. Kale and B. W. Khule. 1996. *Vegetable Seed Production Technology*. Maharashtra State Seed Corp.
- Singh N.P., D. K. Singh, Y. K. Singh and V. Kumar. 2006. *Vegetable Seed Production Technology*. International Book Distributing Co.



Code No: ANS 325

Course Title: Principles and Practices of Animal Breeding

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: The objective of this course is to provide students with comprehensive knowledge of basic principles and its application in improving breeds of farm animals.

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: importance, scope and history of animal breeding; indigenous breeds and their economic values, animal genetic resources and sustainable development. 4 hrs

Unit 2. Rare breeds of different species of animal and their characteristics; reasons for being endangered and strategies for conservation. 4 Hrs

Unit 3. Genetic principles of animal breeding. 3 Hrs

Unit 4. Variation: concept of variation, importance of variation, causes of variation; 2 Hrs

Unit 5. Heredity: meaning and importance of heredity; heredity and environment; heritability, repeatability and their estimates. 3 Hrs

Unit 6. Breeding system and selection: principles, basis, method and selection parameters; important economic traits of livestock and poultry; breeding plan. 5 Hrs

Unit 7. Mating system: inbreeding and out breeding. 2 Hrs

Unit 8. Genetic resistance to diseases and parasites. 2 Hrs

Unit 9. Transgenic animals and their production. 2 Hrs

Unit 10. Animal biotechnology and recent advances in animal biotechnology. 3 Hrs

B. Practical (30 Hrs)

| SN | Topics | Practical |
|----|---|-----------|
| 1 | Use of statistics in animal breeding | 1 |
| 2 | Estimation of heritability by using regression and correlation | 1 |
| 3 | Estimation of heritability by using twin comparison and selection | 1 |
| 4 | Estimation of heritability by one way and nested design | 2 |
| 5 | Estimation of repeatability | 1 |
| 6 | Estimation of variance components and means | 2 |
| 7 | Breeding value, PBA and MPPA | 2 |
| 8 | Calculation of inbreeding relationship and coefficient | 2 |

| | | |
|----|--|---|
| 9 | Estimation of selection parameters and selection index | 2 |
| 10 | Preparation of breeding Plan | 1 |

References:

Lasley, J. F. 1988. Genetics of Livestock Improvement 3rd ed. Prentice Hall. Inc. Englewood Cliffs, New Jersey

Lush, J. L. 1960. Animal Breeding Plan. Iowa State University Press, Iowa, USA

Nicholl, D. S. T. 1994. An Introduction to Genetic Engineering. Cambridge University Press

D. Shukla

Code No: SOS 324

Course Title: Soil Conservation and Watershed Management

Credits: 2+1

Nature of the Course: Theory + Practical

Teaching hours: 30+30

Objectives: Upon completion of the course, the students will be able to understand the fundamental concepts of soil conservation and watershed management. The students will also be able to describe watershed characteristics, calculate the loss of soil and water quantities from a given piece of land in the watershed, analyze biophysical data for watershed management plans, gain skills of doing conservation practices and also learn the institutional aspect of the watershed.

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: importance of soil and its conservation, hydrology and hydrological cycle, branches of hydrology, importance of hydrological knowledge in planning natural resources in Nepal and human influences in hydrological process (3 hrs)

Unit 2. Mechanics and form of water erosion: definition of soil erosion, erodivity of rainfall and run-off, factors affecting soil erodivity and types of soil erosion by water: splash, rill, sheet, gully and stream channel erosion, landslide, landslip and mass movement (5hrs)

Unit 3. Mechanics of wind erosion: wind erosion process, factors affecting wind erosion and wind erosion control (2hrs)

Unit 4. Soil erosion monitoring and estimation: simple visual method for soil erosion monitoring, runoff plot monitoring, sedimentation survey, empirical methods for soil loss estimation –universal soil loss equation (USLE and revised USLE), soil and water assessment tool (SWAT). 3 Hrs

Unit 5. Consequences of soil erosion: (a) fertility loss and land degradation, (b) flood, landslide and natural hazards, (c) on-site and off-site effects and (d) socio economic consequences (3hrs)


Unit 6. Conservation of soil erosion: soil erosion control: (a) soil erosion control in agriculture land-mulching, conservation tillage, strip planting, cover cropping, contour farming, sloping agriculture land technology (SALT); (b) soil erosion control in forest and rangelands- afforestation and controlled grazing; (c) bio-engineering measures for slope stabilization; (d) engineering measures – check dams, retaining wall, water ways, terracing, embankment, spur, and spillways (6hrs)

Unit 7. Land use plan: land use capability classification of land (2 hrs)

Unit 8. Watershed and watershed management: (a) definition, concept and characteristics of watershed and sub-watershed, (b) watershed approaches in soil and water management, and (c) concept of integrated watershed management (3hrs)

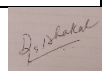
Unit 9. Soil conservation and watershed management in Nepal: 3 Hrs

- a. Institutional arrangement
- b. Legislation and regulation: Soil and Watershed Conservation Act of Nepal – 2039, 2072 (revised)
- c. Approach of Department of Soil Conservation and Watershed Management (3hrs)



B. Practical (30 Hrs)**B. Practical (30 Hrs)**

| S.N. | Topic | Practical |
|------|--|-----------|
| 1 | Observation of on-farm impacts of different forms of accelerated soil erosion | 1 |
| 2 | Observation of off-site impacts of accelerated soil erosion | 1 |
| 3 | Classification of a micro-watershed based on soil type, slope, topography, vegetation, land-use and settlements | 1 |
| 3 | Social survey of soil losses from farm lands | 1 |
| 4 | Monitoring of soil erosion process using a run-off plot | 1 |
| 5 | Infiltration and runoff under vegetated and non-vegetated lands | 1 |
| 6 | Sedimentation survey at the downstream of a small watershed | 1 |
| 7 | Description of model for soil loss estimation using a Revised Soil Loss Equation (RUSLE) | 1 |
| 8 | Description of model for soil loss estimation using soil water assessment tool (SWAT) | 1 |
| 9 | Construct a hydrograph deriving discharge rate at the outlet of a watershed for a specified time. | 1 |
| 10 | Demonstrate the use of GIS, remote sensing and GPS application on database development and analysis of a watershed | 1 |
| 11 | Exercise on computing rain-related factor required for RUSLE | 1 |
| 12 | Exercise on computing soil-related factor required for RUSLE | 1 |
| 13 | Exercise on computing land-management factors required for RUSLE | 1 |
| 14 | Exercise on soil loss estimation using RUSLE | 1 |
| 15 | Study of rainfall simulator for erosion assessment | 1 |

**References**

Brook, K.N., P.F. Flolliot, H.M. Gregersen and J.L. Thames. 1991. Hydrology and the Management of Watershed. IOWA University Press, USA

Hillel, D., 2018. Introduction to Environmental Soil Physics. Elsevier, 2018.

FAO. 1977. Guidelines for Watershed Management. FAO Field manual

Ray, R. W. and N.C. Brady. 2017. The Nature and Properties of Soils, 15th Ed., Pearson Education Limited

Murty, V..V..N. and M. K. Jha. 2011. Land and Water Management Engineering. ebook. Previous editions published in 1985 by Kalyani Publishers, New Delhi. 2011

Morgan, R. P. C. 2005. Soil Erosion and Conservation, 3rd ed., Blackwell Science publishing, UK

Policy guidelines published as periodicals and bulletins of the Department of Soil Conservation and Watershed Management, Government of Nepal, Kathmandu (www.lawcommission.gov.np).

Tripathi, R.P., and H.P. Singh. 1993. Soil erosion and conservation. Wiley eastern Ltd. New Delhi

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Code No: SOS 325

Course Title: Remote Sensing and GIS in Agriculture

Credits: 1+1

Nature of the Course: Theory + Practical

Teaching hours: 15+30

Objectives: This course aims at familiarizing the students with the concepts of remote sensing (RS) and geographic information systems (GIS) technologies and their application in the field of agriculture.

Course Contents

A. Theory (15 Hrs)

| Unit | Topic | Lecture |
|------|--|---------|
| 1 | Introduction to the concepts of GIS and Remote sensing | 2 |
| 2 | Geographical referencing system in GIS | 2 |
| 3 | Global positioning system (GPS) and satellite imaging | 2 |
| 4 | Methods of data collection and data integration | 3 |
| 5 | Designing a map using ArcView and, or ArcGIS software | 3 |
| 6 | Geo-processing, overlay analysis and report generation | 3 |

A. Practical (30 Hrs)

| S.N. | Topic | Practical |
|------|---|-----------|
| 1 | Hardware and software requirements to implement GIS concept | 1 |
| 2 | Data sources for GIS: RS, GPS, library, office and others | 1 |
| 3 | Geo-referencing scanned image | 1 |
| 4 | Creating and editing geographic data | 1 |
| 5 | Creating and editing attribute data | 1 |
| 6 | Collecting and plotting spatial data using GPS receivers | 1 |
| 7 | Spatial data and attribute data integration and spatial query | 1 |
| 8 | Designing a GIS map: Classifying map and preparing map layout | 1 |
| 9 | Extracting features (clip) and proximity analysis (buffer) | 1 |
| 10 | Overlay analysis (intersect, union) | 1 |
| 11 | Digital elevation model generation | 1 |
| 12 | Slope and aspect generation | 1 |
| 13 | Satellite image analysis and classification | 1 |

| | | |
|----|---|---|
| 14 | Evaluate and interpret results | 1 |
| 15 | Present results of analysis, report design and generation | 1 |

References

Shellito, B. A. 2017. Discovering GIS and ArcGIS. Second edition. New York (NY), W.H. Freeman, Macmillan Learning, 587 pages,

Mesev, V. 2007. Integrating GIS and remote sensing. Chichester, England; Hoboken, NJ; Wiley, 296 pages,

Borra, S., M. R. Thanki. and D. Nilanjan. 2010. Satellite Image Analysis: Clustering and Classification. 210 pages, ebook, ISBN: 978-981-13-6424-2, Springer shop

Geographic Information Systems: An Introduction. 1990. Prentice Hall Inc., Englewood Cliffs, New Jersey

[Ray, R. W.](#) and N. C. Brady. 2017. The Nature and Properties of Soils, 15th Ed., Pearson Education Limited



Code No: HRT 326

Course Title: Postharvest Management of Horticultural Crops

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: The course provides basic knowledge in post-harvest physiology, skills and practices of appropriate harvesting, handling, transportation, packaging, storage, preparation for the market and marketing of fresh horticultural produce and preservation technology.

Course Contents

A. Theory (30 Hrs)

Unit 1. Important of postharvest horticulture: Scope and importance of post-harvest horticulture; major constraints in the development of post-harvest horticulture enterprises in Nepal. **1 Hr**

Unit 2. Structures of fruits, vegetables and flowers: Structure of fruits, vegetables and cut flowers related to physiological changes after harvest. **2 Hrs**

Unit 3. Postharvest physiology: Difference in the physiology of attached and detached organs. Detail study of A. Respiration: Glycolysis, tri-carboxylic acid cycle, electron transport system and anaerobic respirations. B. Transpiration, C. Ethylene Production and its effects, senescence, and other biological changes. **7 Hrs**

Unit 4. Maturity indices, Commercial maturity for harvesting of fruits, vegetables and flowers for local and distance markets: Harvesting stage and method of harvesting of important fruits, vegetables and ornamentals. **2 Hrs**

Unit 5. Packing house operations: Washing, Cleaning, Trimming, Sorting, Grading, Curing, Waxing, Ripening, Degreening, Chemical treatments, Fumigation, Color adding, Pre-cooling and packaging. **4 Hrs**

Unit 6. Physiological disorders of horticultural produce: Different physiological disorders of fruits, vegetables and flowers and there preventive measures **2 Hr**

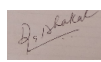
Unit 7. Post-harvest Diseases and Preventive measures: Classification of postharvest diseases based on nature of infection and causal organism and preventive measures. Important postharvest diseases of fruits, vegetables and ornamentals and preventive measures. **3 Hrs**

Unit 8. Postharvest Entomology and Control of insect pests in harvested produce: Protective measures in the field to control insect pests, Cold treatment, Fumigations and Irradiation of harvested produce for the control of different insect pests. **1 Hr**

Unit 9. Post-harvest quality of fruits, vegetables, flowers and various processed commodities: Quality parameters and specification; factor responsible for quality; evaluation of quality; post-harvest treatments to control quality. **2 Hrs**

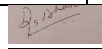
Unit 10. Storage and Transportation: Principles and methods of storage, Transportation of fresh produce to short and long distance markets. Importance of packhouse and cold-chain for postharvest handling of fresh horticultural produce. Design and Management of packhouse for fresh produce. **4 Hrs**

Unit 11. Market and Marketing: Market and marketing system for fresh fruits, vegetables and ornamental horticulture; considerations in marketing; constraints in marketing; measures to be taken for effective marketing of fresh horticultural produce. Fruits and vegetables market in Nepal. **2 Hrs**



B. Practical (30 Hrs)

| SN | Topics | No of practical |
|----|---|-----------------|
| 1 | Study of tools, equipment and chemicals used in post-harvest horticulture. | 1 |
| 2 | Determination of total soluble solids (TSS) and titratable acidity (TA). | 1 |
| 3 | Practice in judging the maturity of various horticultural produce; physical and chemical | 1 |
| 4 | Determination of physiological loss in weight and quality evaluation of various fruits, vegetables and cut flowers in ordinary room condition | 1 |
| 5 | Harvesting of fruits, vegetables and cut flowers for local and export market | 1 |
| 6 | Quality Evaluation, Sorting and Grading of horticultural produce | 1 |
| 7 | Ripening and degreening of fruits. | 1 |
| 8 | Packaging studies in fruits, vegetables, plantation crops and cut flowers by using different packaging materials. | 1 |
| 9 | Identification of post-harvest disorders, disease and pest | 1 |
| 10 | Preparation of jam, Jelly, squash, juice and ketchup | 3 |
| 11 | Visit to markets, packhouses and storage structures and identification of various problems | 1 |
| 12 | Sugar pulsing treatments in cut flowers, study of vase life. | 1 |
| 13 | Sensory evaluation and judgment of quality of fruits and vegetables | 1 |

**Reference Books**

- Gautam, D.M and D.R. Bhattarai, D.R., 2017. *Postharvest Horticulture (2nd ed)*. Heritage Publishers and Distributors, Kathmandu, Nepal, 201 p
- Bautista O.K. 1990. *Postharvest Technology for South East Asian Perishable Crops*. University of the Philippines Technology and Livelihood Resource Center, Philippines.
- Bhutani R.C. 2003. *Fruit and Vegetable Preservation*. Biotech Books.
- Chadha K.L. and Pareek O.P., eds. 1996. *Advances in Horticulture*. Vol. IV. Malhotra Publ. House.
- Gautam D.M., Bhattarai D.R. and S.K. Maharjan 2020. *Postharvest Technology*. Heritage Publishers and Distributors, Kathmandu, Nepal, 306 p

Gautam D. M. and P.G. Burlakoti, 2018. पोस्टहार्भेस्ट प्रविधि (*Postharvest Technology*) . Heritage Publishers and Distributers, Kathmandu, Nepal, 1426 p

Haid N.F. and Salunkhe S.K. 1997. *Post Harvest Physiology and Handling of Fruits and Vegetables*. Grenada Publ.

Ranganna S. 1997. *Hand Book of Analysis and Quality Control for Fruit and Vegetable Products*. Tata McGraw-Hill.

Shrestha K.B. 1996. *Appropriate Post-harvest Technology of Fruits in Nepal*. Uday Research and Development Services Pvt. Ltd.. Kathmandu, Nepal.

Sudheer K.P. and Indira V. 2007. *Post Harvest Technology of Horticultural Crops*. New India Pub. Agency.

Willis R., McGlassen W.B., Graham D. and Joyce D. 1998. *Post Harvest: An Introduction to the Physiology and Handling of Fruits, Vegetables and Ornamentals*. CABI.

Code No: PLP 323

Course Title: Plant Clinic

Credits: 0+2

Nature of the Course: Practical

Teaching hours: 60

Objectives: Upon the completion of the course, the student will be able to skill in diagnosis of disease, insect pest infestation, physiological disorders and nutrient deficiency in crops and their management


Course Contents: Regular field observation, monitoring and sampling of sick /unhealthy crops for laboratory and field diagnosis for problem identification related to diseases, insect pest infestation, nutrient deficiency and physiological disorders. The problem identification is a multi-disciplinary approach involving plant pathology, entomology, soil science and plant physiology.



YEAR IV

Semester I

| Course Code | Title of Course | Credit |
|-------------|---|---------|
| HRT 417 | Plant Propagation and Nursery Management | 1+1 |
| HRT 418 | Agroforestry | 1+1 |
| ENT 414 | Industrial Entomology | 1+1 |
| ENS 412 | Environmental Science and Agro-ecology | 2+0 |
| ANS 416 | Introductory Dairy Technology | 2+1 |
| AGR 416 | Principles and Practices of Organic Farming | 2+1 |
| ECN 416 | Agriculture Finance | 2+0 |
| ECN 417 | Agriculture Project Planning | 1+1 |
| INT 411 | Internship I (Planning and Presentation of Project) | 0+1 |
| | Total | 12+7=19 |



Code No: HRT 417

Course Title: Plant Propagation and Nursery Management

Credits: 1+1

Nature of Course: Theory + Practical

Teaching hours: 15+30

Objectives: Upon the completion of the course the students will develop knowledge and skill in different types of plant propagation methods and commercial plant nursery management.

Course Contents

A. Theory (15 Hrs)

Unit 1. Basics of propagation: propagation: need and potentialities for plant multiplication, sexual and asexual methods of propagation, advantages and disadvantages; seed dormancy- internal and external factors, scarification and stratification, nursery techniques; apomixes- mono- polyembryony, chimera and bud sport. (2 Hrs)

Unit 2. Propagation media: media, characteristics of good media, types of media such as peat, sphagnum moss, perlite, vermiculite, (2Hrs)

Unit 3. Propagation structures and containers: mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, containers, nursery (tools and implements). (2 Hrs)

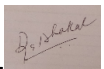
Unit 4. Principles of propagation: physiological & bio chemical basis of grafting, cutting, layering, rooting, factors influencing rooting of cuttings and layering; graft incompatibility; scion-stock relationship, and their influences, anatomical studies of bud union, (2 Hrs)

Unit 5: Propagation methods: techniques of cutting, layering, grafting and budding; propagation through specialized organs: corm, suckers and runners; selection and maintenance of mother trees, collection of scion wood stick, bud wood certification, use of growth regulators in seed and vegetative propagation, (2 Hrs)

Unit 6. Propagation through tissue culture: principles and techniques of tissue culture, micro-grafting; hardening of plants in nurseries; insect/pest/disease control in nursery. (3 Hrs)

Unit 7. Commercial nursery management: legal aspects and economics of operating a commercial nursery, quality control, shipping practices and financial management, site selection, nursery layout, supply purchasing, advertising related to nursery business. (2 Hrs)

B. Practical (30 Hrs)

| SN | Topics/exercise | Practical |
|----|--|---|
| 1 | Preparation of media, nursery beds and sowing of seeds, raising of rootstock. | 2 |
| 2 | Preparation of plant material for potting | 1 |
| 3 | Seed treatments for breaking dormancy | 1 |
| 4 | Preparation of plant growth regulators for seed germination and vegetative propagation | 1  |

| | | |
|----|---|---|
| 5 | Practicing different types of cutting | 1 |
| 6 | Practicing different types of layering. | 2 |
| 7 | Practicing different types of grafting | 2 |
| 8 | Practicing different types of budding, | 1 |
| 9 | Visit to tissue culture laboratory and commercial nursery | 2 |
| 10 | Study and cost estimate of green house, mist chamber, polyhouse and their maintenance | 1 |
| 11 | Prepare business plan | 1 |

References

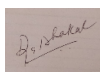
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Peter K.V. 2008. *Basics of Horticulture*. New India Publ. Agency, India.

Radha T. and Mathew L. 2007. *Fruit Crops*. New India Publ. Agency, India.

Rajan S. and Baby L.M. 2007. *Propagation of Horticultural Crops*. New India Publ. Agency, India



Code No: HRT 418

Course Title: Agroforestry

Credits: 1+1

Nature of Course: Theory + Practical

Teaching hours: 15+30

Objectives: The main objective of this course is to give knowledge about how trees, people and agriculture can be combined in sustainably managed farms, forests and landscapes.

Course Contents

A. Theory (30 Hrs)

Unit 1. Agroforestry – definition, objectives and potential. Distinction between agroforestry and social forestry. Status of Nepalese forests and role in Nepal farming systems. **2 Hrs**

Unit 2. Agroforestry system, sub-system and practice: agri-silviculture, silvi-pastoral, horti-silviculture, horti-silvipastoral, shifting cultivation, *taungya*, slopping land technology (SALT), home gardens, alley cropping, intercropping, wind breaks, shelterbelts and energy plantations. **5 Hrs**

Unit 3. Planning for agroforestry – constraints, diagnosis and design methodology, selection of tree crop species for agro-forestry. **4 Hrs**

Unit 4. Agroforestry projects – national, overseas, MPTS – their management practices, economics of cultivation – nursery and planting (*Acacia catechu*, *Dalbergia sissoo*, *Tectona*, *Populus*, *Morus*, *Grewia*, *Eucalyptus*, *Quercus* spp. and bamboo, tamarind, neem etc.). **4 Hrs**

B. Practical (30 Hrs)

Identification and seeds and seedlings of multipurpose tree species. Nursery practices for poplar, *Grewia optiva*, *Morus alba*, *Acacia catechu*, *Dalbergia sissoo*, *leucaena* etc. Visit to agro-forestry fields to study the compatibility of MPTS with agricultural crops: silvipastoral, alley cropping, horti-silviculture, agro-silvipasture, fuel and fodder blocks. Visit to social forestry plantations, roadside plantations, industrial plantations and shelterbelts. Rapid assessment of farmers needs for green manure, fodder, fuel wood in selected villages. Economics and marketing of products raised in agro-forestry systems.

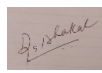
References

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Chauhan S.K. 2005. *Agroforestry in 21st Century*. Punjab Agricultural University, India.

Huxley P. 1999. *Tropical Agroforestry*. Blackwell Publication.

Sinclair F.L. 1995. *Agroforestry: Science, Policy and Practice*. Kluwar Academic Publ.



Code No: ENT 414

Course Title: Industrial Entomology

Credits: 1+1

Nature of Course: Theory + Practical

Teaching hours: 15+30

Objectives: Upon the completion of the course, the students will be able to gain knowledge and skill in production and management of honey bees, silkworm and lac.

Course Contents

A. Theory (15 Hrs)

Unit 1. Beneficial insects: their roles in food, medicine, industry, and environmental indicators; 1 Hr

Unit 2. Apiculture: importance and scope in Nepal, role of beekeeping in pollination; major honey bee species: exotic and indigenous, 2 Hr

Unit 3. Morphology and anatomy of honeybees; honeybee races, bee colony, bee activities and behavior. 2 Hrs

Unit 4. Modern bee hives and beekeeping, seasonal management of bee colony, artificial feeding, bee forage and pollination plan. 2 Hrs

Unit 5. Honeybee products and honey extraction, production of queen, and queen management, 2 Hr

Unit 6. Enemies of honeybees: pests, diseases and pesticide poisoning. 1 Hrs

Unit 7. Sericulture: importance and scope, life cycle, silkworm rearing, food plants, cocoon production and processing; enemies and diseases of silkworm. 3 Hrs

Unit 8. Lac culture: introduction of lac insect, importance and lac production techniques. 2 Hrs

B. Practical (30 Hrs)

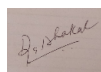
(i) Morphology and anatomy of honeybee. (ii) Races of honeybees and types of bee hives. (iii) Honey bee behavior and communication. (iv) Artificial feeding during off-season. (v) Rearing honeybees and handling of a honeybee colony. (vi) Queen preparation and maintaining bee colony. (vii) Bee foragers/pastures. (viii) Use of honeybees in crop pollination Enemies of honeybees. (ix) Honey extraction, wax and other products of bee hive. (x) Maintaining bee keeping records. (xi) cocoon production (xii) silk extraction (xii) Visit to sericulture and apiculture farm

References

Abrol D.P. 1997. *Bees and Beekeeping in India*. Kalyani Publishers, New Delhi, India.

Mishra R.C. 1998. *Perspective in Indian Apiculture*. Agrobotanica, New Delhi.

Shukla A. 2000. *Beekeeping Trainer's Resource Book*. ICIMOD, Kathmandu, Nepal. (in Nepali).



Code No: ENS 412

Course Title: Environmental Science and Agro-ecology

Credits: 2+0

Nature of Course: Theory

Teaching hours: 30

Objectives: Upon the completion of the course, the student will be able to understand the different aspects of environmental science and agro-ecology, environmental issues and conservation of natural resources for sustainability

Course Contents

Theory (30 Hrs)

Unit 1. Basic Components of Environment: atmosphere- structure, importance, meteorological condition, and air circulation; hydrosphere- importance, physiochemical properties, global distribution; and lithosphere- rocks and disintegration of rocks and soil formation. 3 Hrs

Unit 2. Biosphere and Biomes: structure and composition of biosphere, ecosystem, energy flow and biogeochemical cycle, and system homeostasis; major biomes of the world: major terrestrial (tropical rain forest, tropical seasonal forests, tropical woodlands and thornlands, tropical grasslands and savannas, temperate rain forests, temperate deciduous forests, temperate woodland and shrublands, temperate grasslands, hot deserts and cool deserts, alpine shrublands/grasslands); freshwater aquatic biomes; lentic (lakes and ponds), lotic (rivers) and wetlands (swamps and marshes). 4 Hrs

Unit 3. Ecosystem Services: concept and categories, carbon sequestration and carbon trade, concept of REDD, watershed services (upstream- downstream linkages). 3 Hrs

Unit 4. Environmental Issues: human population, deforestation and land use, urbanization, chemical fertilizers, pesticide uses and abuse, global environmental change (weather and climate), invasive species, human health (heat stress and migration of disease vectors), water security and food security, environmental toxicants (toxins of biological and non biological origin) 5 Hrs.

Unit 5. Energy Issues: renewable energy resources (wind, solar and biofuel) and non renewable resources (hydropower, coal and gas). 2 Hrs

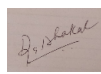
Unit 6. Natural Resource Management: concept, participatory technology development (PTD) approaches for NRM in context of Nepal with some case studies as examples, environmental indicators – role of plants in environmental monitoring, bioengineering. 3 Hrs

Unit 7 Environmental Impact Assessment (EIA): origin and development, IEE and EIA process, a case study of any development project in Nepal; environmental organization, international convention with reference to various treaties and environmental laws. 3 Hrs.

Unit 8. Environmental Impact on Agriculture: ecological degradation by pesticides and chemical fertilizers; deforestation and soil erosion, declining soil fertility and productivity, and reduction in biodiversity. 2 Hrs

Unit 9. Agro-ecology of Production System: agro-ecology of shifting cultivation, multiple cropping, crop rotation, cover cropping, agroforestry system, conservation agriculture, principles of conservation agriculture and organic farming; definition, advantage and limitation of sustainable agriculture; ecological aspect of organic farming; 3 Hrs

Unit 10. Properties of Agro-ecosystem: productivity, stability, equitability and sustainability; challenges, strategies and requirement of sustainability. 2 Hrs



References:

- Altieri, M. A. 1997. Agro-ecology: Scientific Basis of Alternative Agriculture. Division of Biological Control, University of California.
- Asthana, D. K. And M. Asthana. 2005. Environment: Problems and Solutions. S. Chanda and Co. Ltd, New Delhi
- Conway, G. R. 1996. Agro-ecosystem Analysis for Research and Development. Winrock International, Bangkok
- Chaudhary, R. P. 1998. Biodiversity in Nepal: Status and Conservation. S. Devi Saharanpur, India
- Miller, G. T. and S. Spoolman. 2007. Environmental Science: Problems, Connections and Solutions. Thomson Brook/Cole
- Rana, V. S. P. 2010. Essentials of Ecology and Environmental Science. PHI Learning Pvt Ltd, New Delhi
- Upreti, B. 2003. Environmental Impact Assessment: Process and Practice. Mrs Uttara Upreti, Koteshor, Kathmandu
- Sharma, P. D. 2007. Ecology and Environment. BPR Publisher
- Stocking, M., H. Helleman and R. White (eds). 2005. Renewable Natural Resource Management for Mountain Communities. ICIMOD, Nepal



Code No: ANS 416

Course Title: Introductory Dairy Technology

Credits: 2+1

Nature of Course: Theory + Practical

Teaching hours: 30+30

Objectives: Upon the completion of course, the students will be able to gain knowledge and develop skill in sample collection, laboratory testing and standardization of milk and milk products

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction: Dairying in Nepal, comparison of Nepalese with that of developed countries, and its importance, problems and prospect of in Nepal. 3 Hrs

Unit 2. Milk: definition, diagrammatic representation of milk constituents, composition, nutritive value, physical and chemical properties of milk, factor affecting the composition of milk. 5 Hrs

Unit 3. Physiology of Lactation: mammary glands and hormones related to development of udder, milk secretion and letdown of milk, 5 Hrs

Unit 4. Milking: milking methods, clean milk production, factors affecting clean milk production; natural and off-flavor of milk, flavor defects in milk and their prevention measures. 5 Hrs

Unit 5. Dairy Microbiology: types and sources of microorganisms (MO) found in milk, uses of beneficial MO and significance of MO in dairy industry. 5 Hrs

Unit 6. Processing of Milk: methods and procedure of pasturization. 3 Hrs

Unit 7. Dairy Products: preparation of Ghee, Butter, Dahi, Cheena, Khowa, Paneer and Ice Cream). 4 Hrs

B. Practical (30 Hrs)

| SN | Topics | Practical |
|----|---|-----------|
| 1 | Identification and description of dairy equipment | 1 |
| 2 | Sampling of milk | 1 |
| 3 | Sediment test by using disc and sediment tester | 1 |
| 4 | Determination of fat by Gerber's Method | 1 |
| 5 | Determination of specific gravity, SNF and TS | 1 |
| 6 | COB and titratable acidity test in milk | 1 |
| 7 | MBR test for assessing microbial quality of milk | 1 |
| 8 | Study of mammary gland and physiology of lactation | 2 |
| 9 | Estimation of MO by using microscope and CMT paddle | 2 |
| 10 | Standardization of milk and cream | 1 |


| | | |
|----|---|---|
| 11 | Preparation of Dahi, Cheena, Paneer and Ice cream | 2 |
| 12 | Visit to nearby dairy processing plant | 1 |

References:

Clarence, H.E., W. B. Comb and H. May.1994. Milk and Milk Products. TATA MacGraw Hill Publishing Co. Ltd, India

Prasad, J. 1997. Animal Husbandry and Dairy Science. Kalyani Publishers. India

Sukumar, D. 2000. Outline of Dairy Technology. Oxford University Press. India



Code No: AGR 416

Course Title: Principles and Practices of Organic Farming

Credits: 2+1

Nature of the Course: Theory + Practical

Teaching hours: 30+30

Objectives: Upon the completion of the course the students will be able to explain the basic concepts, principles and practices of organic farming.

Course Contents

A. Theory (30 Hrs)

Unit 1. Introduction to organic agriculture: definition, similarities and dissimilarities among terminologies-organic agriculture, permaculture, biodynamic agriculture, Vedic agriculture, natural farming, conservation agriculture, sustainable agriculture, alternative agriculture, low external input sustainable agriculture (LEISA); Green Revolution and its impact on ecosystem, environment and food quality and human health. Organic agriculture: definition, concept, importance, and relevance in Nepal; status, challenges and opportunities of organic agriculture in Nepal 5 hrs.

Unit 2. Principles of organic agriculture: The principles of health, ecology, fairness and equity and care of earth and environment. Objectives of organic agriculture, differences among conventional, integrated and organic agriculture. 3 hrs.

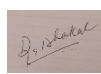
Unit 3. Soil health and soil quality for organic agriculture: The concept of soil quality/soil health, the components of soil quality for environmental protection, sustaining crop and animal productivity and promoting human health. Soil ecology and soil as living body, functions and roles of organic matter, organic matter management for crop production, crop rotation, green manuring, biofertilizer, crop residue management, use of compost and legumes integration for maintaining soil organic matter 5 hrs

Unit 4. Organic pest , diseases and weed management: History ,scope and need of eco-friendly approaches of pests, diseases and weed management, concept and philosophy, ecological principles, ETL and economic consideration, tools of pest management and their integration, legislative, physical, cultural, mechanical and biological methods, pest survey and surveillance, non- chemical approaches for management of agronomical and horticultural crop pest diseases and weeds. 5 hrs

Unit 5. National standards and guidelines for organic agriculture in Nepal : General guidelines for conversion period, soil, water, nutrient and crop variety, composting and source of organic matter, diseases, insects and weed management, livestock production and management, organic product processing, packaging, and storage. 4 hrs.

Unit 6. Quality aspects of organic food product: Importance of quality food, its characteristics, safety issues. Different National and International standards; shelf life of organic food, sample and sampling techniques, assessment of quality of organic food product, and pesticides residues in food.4 hrs

Unit 7. Organic product certification, accreditation and marketing of organic food: Organic product certification process in the world, importance and need for certification and accreditation, certification process and practices in Nepal; marketing aspect of organic product and export of organic food in foreign countries 4 hrs




B.Practical (30 hrs)

| SR No. | Title | Number of Practical |
|--------|--|---------------------|
| 1. | Determining soil quality : organic matter, P ^H , bulk density, soil moisture and infiltration rate from organic and non-organic field | 2 |
| 2. | Survey of the farmers field for the application of pesticides in crops | 2 |
| 3. | study of various types of improved composting / Vermi-composting techniques | 2 |
| 4 | Study of Crop rotation/ Legume integration/ / green manuring/ brown manuring on soil properties/growth and yield of succeeding crops | 2 |
| 5 | Study of mulching/ crop residues management on crop growth and yield | 2 |
| 6. | Study of crop growth and yield in protected house/tunnels/ green house | 1 |
| 7. | Seasonal cultivation of crops using organic principles | 2 |
| 8. | Visit to organic agriculture farm | 1 |
| 9. | Study of alternative methods of insects/ weeds/ disease management- use of light trap/ pheromone trap/ other indigenous non chemical methods. | 1 |

References:

1. Sharma, A. K. (2018). A handbook of organic farming. Agrobios (India)
2. Palaniappan, S.P. (2018) Organic farming: Theory and practice, Agrobios(India)
3. Shimpei Murakami. 1991. Lessons from Nature. A Guide to Ecological Agriculture in the Tropics. NongJok Natural Farming Center. Bangkok. Thailand.
4. Sharma,G. and Thapa, P.B.(2005) Proceeding of National Workshop on Organic Agriculture and Food Security.Dec 13-15, 2005. Kathmandu, Nepal
5. Joshi, M.R.,A Shrestha and P.B. Thapa.2007. Proceeding on National follow up Workshop on Organic Agriculture and Food Security. Nepal Permaculture Group, Babarmahal, Kathmandu, Nepal.



Code No: ECN 416

Course Title: Agriculture Finance

Credits: 2+0

Nature of Course: Theory

Teaching hours: 30

Objectives: Upon completion of this course, the students will be able to understand the general concept and scope of agricultural finance, as well as become able to do financial analysis of the farm businesses.

Course Contents

Theory (30 hours)

Unit 1: Introduction to agricultural finance: concept and meaning of agricultural finance, scope of agricultural finance, significance of agricultural finance, role of finance in agricultural development (4 hrs)

Unit 2: Financial markets: financial markets and financial intermediaries, characteristics of rural financial markets, problems of rural/agricultural financial markets (3 hrs)

Unit 3: Financial institutions: financial institutions in Nepal, functions of the financial institutions – Nepal Rastra Bank (NRB), commercial banks, development banks, finance companies, micro-finance, cooperatives (4 hrs)

Unit 4: Agricultural credit: concept of agricultural credit, types and sources of agricultural credits, three R's of credit, loan interest rates, types of interests, credit acquisition and repayment schedule (4 hrs)

Unit 5: Rural indebtedness: concept of rural indebtedness, problems and causes of rural indebtedness, ways of reducing the rural indebtedness (2 hrs)

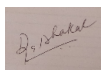
Unit 6: Capital investment analysis: time value of money, discounted and undiscounted measures to appraise the investment, Payback period (PBP), Net Present Value (NPV), Benefit-Cost Ratio (BCR), Internal Rate of Return (IRR) (5 hrs)

Unit 7: Financial statement and analysis: farm inventory, depreciation, balance sheet, income statement, breakeven analysis, ratios analysis from the financial statement (5 hrs)

Unit 8: Agricultural business: principles of agricultural business, agribusiness institutions in the public and private sectors, agricultural insurance and risk management (3 hrs)

References:

1. Barry, P. and P. Ellinger. 2011. Financial Management in Agriculture. 7th Edition. Pearson Education.
2. Moss, C.B. 2013. Agricultural Finance. 1st Edition. Routledge, London.
3. Broadway, A.C. and A.A. Broadway. 2002. A Text Book of Agri-Business Management. Kalyani Publishers, New Delhi.



Code No. ECN 417

Course Title: Agriculture Project Planning

Credits: 1+1

Nature of Course: Theory + Practical

Teaching hours: 15+30

Objectives: Upon the completion of the course, the students will be able to identify the researchable area, prepare research proposal in agriculture and rural development, and implement, monitor and evaluate research and development programs.

Course Contents

A. Theory (15 Hrs)

Unit 1. Basic concept: plan, program and project; project cycle; need assessment and problem identification. 2 Hrs

Unit 2. Project preparation: different aspects of project preparation (PESTEL Analysis). 1 Hr

Unit 3. Proposal: concept, type, methods and basic steps; 1 Hr

Unit 4. Scientific research proposal writing: LFA, PCN and full proposal for grant application. 2 Hrs

Unit 5. Project appraisal: concept and techniques. 1Hr

Unit 6. Monitoring and evaluation: concept types and techniques; participatory approach of M and E. 1 Hr

Unit 7. ZOPP approach in project planning. 1 Hr

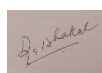
Unit 8. Socio-economic research methods. 2 Hrs

Unit 9. Presentation of research findings: writing thesis, paper, poster and scientific communication. 2 Hrs

Unit 10. Abstract, summary, conclusion, reference, appendices, footnotes and acronyms. 2 Hrs

B. Practical (30 Hrs)

| SN | Topic | Practical |
|----|---|-----------|
| 1 | Need assessment / case study | 2 |
| 2 | Pre-feasibility and feasibility of project | 2 |
| 3 | Economic and financial analysis of the project from sample survey | 3 |
| 4 | Preparation of concept note (PCN) | 2 |
| 5 | Preparation of full article | 2 |
| 6 | Technical writing | 4 |
| | Total | 15 |



References:

NEDA. 1984. Project Development Manual. National Economic Development Authority,. Philippines

Gitinger, J. P. 1982. Economic Analysis of Agricultural Project. Economic Dev. Inst. of ADB, The John Hopkins University Press, Baltimore

Reutlinger, S. 1970. Techniques for Project Appraisal under Uncertainty. John Hopkins University Press, Baltimore

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Code No: INT 411

Course Title: Internship I (Planning and Presentation of Project)

Credits: 0+1

Nature of the Course: Practical


Practical: 30 Hours

Objectives: Upon the completion of the course, the student will be able to identify the researchable area and prepare research proposal

Preparation of proposal: (1) During 7th Semester the student will prepare a project proposal on any ONE of the three options: (1) field experiment, (2) a case study of agro-industry and (3) typical agriculture village profile. The proposal will be presented orally to Internship Committee. The committee will approve the proposal with some modification (if any) to undertake during 8th semester.

Semester II

| Course Code | Title of Course | Credit |
|-------------|--|---------|
| INT 422 | Internship II (A Case Study / Field Experiment) | 0+9 |
| INT 423 | Seminar (Presentation of Research Findings) | 0+1 |
| | Total | 0+10=10 |



Code No: INT 422

Course Title: Internship II (Case Study / Field Experimentation)

Credits: 0+9

Nature of the Course: Practical

Practical: 30 Hours

Objectives: The objective of this course is to expose students to real agri-business environment and field research which will develop skill, confidence and motivation in students to initiate his/or her own business enterprise and also develop capability to prepare research /development project proposal, implement and present the findings of project.

Internship: The proposal approved in 7th semester will be implemented during 8th semester. The student opting for a case study of agro-industry or village profile will be placed in agro-business enterprise/typical agriculture village for a period of 3 (months under the supervision of manager or managing director of the industry or supervisor assigned by the campus. He will work in the industry or in the village and at the same time he will collect data of different activities of the industry/ village for report preparation. After the internship of 3 months, the student will be given additional 30 days for data analysis and report writing. The report should be written in thesis format and presented in the seminar organized by Internship Committee. After the approval of report by the committee, the student is required to submit the final report to the campus.

The potential agribusiness organizations will be identified for the placement of students. The agro-enterprises for student placement will be poultry farm, dairy farm, animal farm, tea or coffee plantation, horticulture farm, fruit and flower nurseries, fruit processing plants, fruit and vegetable markets and other related agro-enterprises. The individual student will be placed in those agro-industries for three (3) months.

Similarly, the student opting for **field research** will undertake field research work under the supervision of assigned supervisor. He will set of field experiment, collect data, analyze the data and prepare report in thesis format and present it in the seminar organized by Internship Committee.

Evaluation: The student will be evaluated jointly by the immediate supervisor of the industry and the course supervisor/teacher assigned by the Campus. Out of 100 full marks, 25 percent is allocated for immediate supervisor at the industry and 75 percent for the Internship Committee constituted by the Campus.

Formation of Internship Committee

- | | |
|---|----------|
| 1. Compus Chief : | Chairmen |
| 2. Chairman of the related Department : | Member |
| 3. Supervisor/Guade of the student: | Member |

Code No: INT 423

Course Title: Seminar

Credits: 0+1

Objectives: Upon the completion of course, the students will be able to develop knowledge, skill and confidence in literature search, processing of data and oral presentation

Seminar: Presentation of research findings in the seminar organized by Internship Committee

