

Rajashri Janak University
Bachelor in Agriculture (B.Sc. Ag.) Program
Course Syllabus

**Semester-wise Course/Subject Outlines of
B.Sc. Ag. Program**

1st Semester

S.N.	Code	Course Title	Cr. Hr.	Th	Pr	Total Cr. Hr.
1	BSC111	Fundamentals of Plant Biochemistry	2+1	2	1	3
2	ENT111	Fundamentals of Entomology	2+1	2	1	3
3	SSC111	Fundamentals of Soil Sciences & Geology	2+1	2	1	3
4	HRT111	Fundamentals of Horticulture	2+1	2	1	3
5	AGR111	Fundamentals of Agronomy	2+1	2	1	3
6	ASC111	Fundamentals of Livestock Production and Management	2+1	2	1	3
7	EXT111	Rural Sociology & Educational Psychology	2+1	2	1	3
8	AEC111	Fundamentals of Agricultural Economics	2+0	2	0	2
Total			16+7	16	7	23
Non-Gradial Course Yoga & Physical Education			0+2	0	2	2

2nd Semester

S.N.	Code	Course Title	Cr. Hr.	Th	Pr	Total Cr. Hr.
1	BSC122	Fundamentals of Crop Physiology	2+1	2	1	3
2	PLB121	Fundamentals of Genetics	2+1	2	1	3
3	PLP121	Fundamentals of Plant Pathology	2+1	2	1	3
4	AGR122	Cereal Crop Production	2+1	2	1	3
5	AEC122	Farm Management & Production Economics	2+1	2	1	3
6	SSC122	Soil Fertility Management	2+1	2	1	3
7	ASC122	Fundamentals of Animal Nutrition, Rangeland and Forage Science	1+1	1	1	2
8	EXT122	Fundamentals of Agricultural Extension	2+1	2	1	3
Total			15+8	15	8	23

3rd Semester

S.N.	Code	Course Title	Cr. Hr.	Th	Pr	Total Cr. Hr.
1	BSC213	Fundamental of Agricultural Microbiology	2+1	2	1	3
2	AEC213	Agriculture Marketing and Cooperatives	2+0	2	0	2
3	SSC213	Fundamental of Climate and Agro meteorology	2+1	2	1	3
4	PLP212	Disease Management of Agronomical Crops	2+1	2	1	3
5	AGR213	Grain Legumes and Oilseed Crops	2+1	2	1	3

6	HRT212	Fruit and Plantation Crop Production	2+1	2	1	3
7	PLB212	Fundamental of Plant Breeding	2+1	2	1	3
8	AQU211	Fundamental of Aquaculture and Fishery	2+1	2	1	3
Total			16+7	16	7	23

4th Semester

S.N.	Code	Course Title	Cr. Hr.	Th	Pr	Total Cr. Hr.
1	ECO221	Environmental Science and Agro ecology	2+0	2	0	2
2	EXT 223	Agricultural Communication and Digitization	2+1	2	1	3
3	AGR224	Commercial Crops	1+1	1	1	2
4	BSC 221	Biostatistics and Computer Application	2+1	2	1	3
5	HRT223	Vegetable and Spice Crop Production Pesticide Hazards and Integrated Pest	2+1	2	1	3
6	ENT223	Management	2+1	2	1	3
7	SSC224	Soil Physics, Genesis and Classification	1+1	1	1	2
8	ANB221	Fundamental of Animal Breeding and Genetics	2+1	2	1	3
9	AGR225	Organic Agriculture	1+1	1	1	2
Total			15+8	15	8	23

5th Semester

S.N.	Code	Course Title	Cr. Hr.	Th	Pr	Total Cr. Hr.
1	ECO312	Medicinal and Aromatic Plants	1+1	1	1	2
2	HRT314	Ornamental Horticulture and Landscaping	2+1	2	1	3
3	PLP313	Disease Management of Horticultural Crops Social Mobilization and Community	1+1	1	1	2
4	EXT314	Development	2+1	2	1	3
5	AEC314	Agriculture Project Planning and Development	2+0	2	0	2
6	316	Seed Science and Technology Introductory Soil Conservation, Water	2+1	2	1	3
7	SSC315	Resource Management and GIS Application	2+1	2	1	3
8	PLB313	Molecular and Population Genetics	2+0	2	0	2
9	AEN311	Farm Mechanization	2+1	2	1	3
Total			16+7	16	7	23

6th Semester

S.N.	Code	Course Title	Cr. Hr.	Th	Pr	Total Cr. Hr.
1	AEC325	Agribusiness Management and Entrepreneurship Development	2+1	2	1	3

2	HRT325	Post-Harvest Technology	2+1	2	1	3
3	AGR106	Fundamental of Weed Science	1+1	1	1	2
4	PLB324	Fundamental of Resistance Breeding	2+0	2	0	2
5	ASC323	Fundamental of Dairy Science and Technology Apiculture, Sericulture and Lac Culture	2+1	2	1	3
6	ENT324	Technology	2+1	2	1	3
7	PLP324	Mushroom Cultivation Technology	1+1	1	1	2
8	AEN322	Irrigation Management Practices	2+1	2	1	3
Total			14+7	14	7	21

7th Semester

S.N.	Code	Course Title	Cr. Hr.	Th	Pr	Total Cr. Hr.
1	ECO413	Agrobiodiversity Conservation and Utilization	2+0	2	0	2
2	AEC416	Research Methodology in Social Science	2+1	2	1	3
3	HRT416	Fundamental of Agroforestry Fundamental of Biotechnology and	1+1	1	1	2
4	BIT411	Bioinformatics	2+1	2	1	3
5	AGR417	Farming System and Precision Agriculture	2+1	2	1	3
6	AEN413	Farm Structures and Surveying	2+1	2	1	3
7	ASC414	Human Nutrition and Dietetics	2+0	2	0	2
8	EXT415	Mithila Culture and Agricultural Heritage	1+1	1	1	2
Total			14+6	14	6	20

8th Semester

S.N.	Code	Course Title	Cr. Hr.	Th	Pr	Total Cr. Hr.
	ISP402	Internship Program	0+10	0	10	10
Total			0+10	0	10	10

Total Credit Hour: 169

Department-wise Course Outline

Department of Basic science and Agro-ecology		Cr hr
BSC111	Fundamentals of Plant Biochemistry	2+1
BSC122	Fundamentals of Crop Physiology	2+1
BSC213	Fundamental of Agricultural Microbiology	2+1
BSC 221	Bio-statistics and Computer Application	2+1
ECO 221	Environmental Science and Agro ecology	2+0
ECO 312	Medicinal and Aromatic Plants	1+1
ECO 413	Agrobiodiversity Conservation and Utilization	2+0
Total		13+5

Department of Social Sciences		Cr hr
EXT111	Rural Sociology & Educational Psychology	2+1
EXT122	Fundamentals of Agricultural Extension	2+1
EXT 223	Agriculture communication and Digitization	2+1
EXT 314	Social Mobilization and Community Development	2+1
EXT 415	Mithila Culture and Agricultural Heritage	1+1
	Sub total	9+5
AEC111	Fundamentals of Agricultural Economics	2+0
AEC122	Farm Management & Production Economics	2+1
AEC 213	Agriculture Marketing and Cooperatives	2+0
AEC 314	Agriculture Project Planning and Development	2+1
AEC 325	Agribusiness Management and Entrepreneurship Development	2+1
AEC 416	Research Methodology in Social Science	2+1
	Sub total	12+4
Total		21+9

Department of Horticulture		Cr hr
HRT111	Fundamentals of Horticulture	2+1
HRT212	Fruit and Plantation Crop Production	2+1
HRT 223	Vegetable and Spice Crop Production	2+1
HRT314	Ornamental Horticulture and Landscaping	2+1
HRT 325	Post-Harvest Technology	2+1
HRT 416	Fundamental of Agroforestry	1+1
Total		11+6

Department of Genetics and Plant Breeding		Cr hr
PLB 121	Fundamentals of Genetics	2+1
PLB 212	Fundamental of Plant Breeding	2+1
PLB 313	Molecular and Population Genetics	2+0
PLB 324	Fundamental of Resistance Breeding	2+0
BIT 411	Fundamental of Biotechnology and Bioinformatics	2+1
Total		10+3

Department of Agronomy		Cr hr
AGR111	Fundamentals of Agronomy	2+1
AGR122	Cereal Crop Production	2+1
AGR 213	Grain Legumes and Oilseed Crops	2+1
AGR 224	Commercial Crops	1+1
AGR 225	Organic Agriculture	1+1
AGR 316	Seed Science and Technology	2+1
AGR 327	Fundamental of Weed Science	1+1
AGR 418	Farming System and Precision Agriculture	2+1
Total		13+8

Department of Soil Science and Agri-engineering		Cr hr
SSC111	Fundamentals of Soil Sciences & Geology	2+1
SSC122	Soil Fertility Management	2+1
SSC213	Fundamental of Climate and Agro meteorology	2+1
SSC 224	Soil Physics, Genesis and Classification	1+1
SSC 315	Fundamental of Soil Conservation, Water Resource Management and GIS Application	2+1
AEN 311	Farm Mechanization	2+1
AEN 322	Irrigation Management Practices	2+1
AEN 413	Farm Structures and Surveying	2+1
Total		15+8

Department of Animal Sciences		Cr hr
ASC111	Fundamentals of Livestock Production and Management	2+1
ASC122	Fundamentals of Animal Nutrition, Rangeland and Forage Science	1+1
AQU211	Principles of Aquaculture and Fishery	2+1
ANB 221	Fundamental of Animal Breeding and Genetics	2+1
ASC 323	Fundamental of Dairy Science Technology	2+1
ASC 414	Human Nutrition and Dietetics	2+0
Total		11+5

Department of Plant Health and Pest Management		Cr hr
ENT111	Fundamentals of Entomology	2+1
ENT222	Insect Pest Management of Field Crops	2+1
ENT 313	Pesticide Hazards and Integrated Pest Management	2+1
ENT 324	Apiculture, Sericulture and Lac Culture Technology	2+1
	Sub total	8+4
PLP121	Fundamentals of Plant Pathology	2+1
PLP212	Disease Management of Agronomical Crops	2+1
PLP313	Disease Management of Horticultural Crops	1+1
PLP 324	Mushroom Cultivation Technology	1+1
	Sub total	6+4
Total		14+8

Course coding system: Letters denote respective department; first digit year, second digit semester and third digit departmental course serial number

First semester courses

Course Code: AEC111

Course Title: Fundamentals of Agricultural Economics

Credit Hours: 2+0 Full Marks: 50 Theory: 50 Practical: 0

Objective

The overall objective of the course is to train students in the general concepts and principles of economics, particularly those related to production, consumption, and distribution applicable in the field of agricultural economics.

Syllabus

The course focuses on the concept and scope of economics, concept and scope of agricultural economics, concepts of economic terms (goods, commodity, service, utility, value, wealth, needs/wants, consumption, and welfare), theory of consumer behavior (cardinal utility, ordinal utility, law of diminishing marginal utility, indifference curve analysis, price effect, income effect, and substitution and income effect of a price change), demand (law of demand, elasticity of demand, and demand function), supply (law of supply, elasticity of supply, and supply function), cost concepts and cost curves, market structure and price determination (perfect competition market, monopoly market, monopolistic market, and oligopoly market), concept of production and factors of production (land, labor, capital, and organization), concept and measurement of national income, and concept of welfare economics and pareto optimality,

Course Breakdown

Theory

S.No.	Topic	No of Lectures
1	Economics: concept and scope of economics, definitions of economics (Adam Smith, Marshall, and Robbins), microeconomics and macroeconomics, positive and normative analysis, and concept and scope of agricultural economics	2
2	Economic terms: goods, commodity, service, utility, value, wealth, needs/wants, consumption, and welfare	1
3	Consumer behavior: concept, cardinal utility, and ordinal utility	1

4	Marginal utility analysis: law of diminishing marginal utility, assumptions of the law of diminishing marginal utility, limitations of the law of diminishing marginal utility, and equilibrium of the consumer through cardinal utility analysis	2
5	Indifference curve: indifference schedule, indifference curve, indifference map, assumptions of indifference curve, properties of indifference curve, and consumer's equilibrium through indifference curve analysis	2
6	Price effect, income effect, and substitution and income effect of a price change	1
7	Demand: concept, law of demand, reasons for the law of demand, elasticity of demand and its application (price elasticity of demand, income elasticity of demand, cross-price elasticity of demand), and determinants of demand and demand function	3
8	Supply: concept, law of supply, elasticity of supply, and determinants of supply and supply function	2
9	Cost: concepts, types of cost (fixed cost, variable cost, explicit cost and implicit cost, social cost, sunk cost, opportunity cost, transaction cost), cost analysis (average cost and marginal cost), short-run and long-run cost curves, and relationship between marginal cost and average cost	1
10	Market: concept, meaning, and types of market, market structure, and concept of firm and industry	1
11	Basic features of perfect competitive market, monopoly market, monopolistic market, and oligopoly market	2
12	Price determination under a perfect competitive market: short-run and long-run equilibrium of firm and industry	1
13	Equilibrium price-output determination under monopoly, monopolistic, and oligopoly markets	2
14	Factors of production, classification and characteristics of land, and theories of rent (Ricardian and modern theories of rent)	2
15	Classification and characteristics of labor, and theories of wage (modern and marginal productivity theory of wages)	2
16	Classification and characteristics of capital, and theories of interest (Keynes liquidity preference theory, classical theory of the rate of interest)	2
17	Organization: concept, classification, and theories of profit	1
18	Concept and measurement of national income: gross domestic product (GDP), real GDP and nominal GDP, gross national product (GNP), and net	1

	national product (NNP)	
19	Concepts of welfare economics and pareto optimality	1
	Total	30

References

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. Singh, C. B., & Singh, R. K. (2011). A Text Book of Agricultural Economics. Laxmi Publications (P) Ltd., India.
4. Sadhu, A. N., Singh, A., & Singh, J. (2022). Fundamentals of Agricultural Economics (11th Ed.). Himalaya Publishing House.
5. Barkley, A., & Barkley, P. W. (2023). Principles of Agricultural Economics (4th Ed.).
6. Koutsoyiannis, A. (1979). Modern Microeconomics. Macmillan Press Ltd., London.

Course Code: ENT 111

Course Title: Fundamental Entomology

Credit Hours: 3 (2+1)

Full Marks: 75

Theory: 50

Practical: 25

OBJECTIVES

Upon the completion of this course, the students will be able to understand the fundamentals of entomology and know the economically important insects.

I. SYLLABUS

Introduction; benefits and harms of insects; morphological features: – cuticle, head, thorax and abdomen; internal anatomy–different systems; metamorphosis and development; classification and study of economically important orders and families of insects

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lectures
1	Introduction	
	1.1 Entomology – definition, disciplines, scope and importance	1
	1.2 Specialties of insects and the causes of success of insects over other creatures	1

	1.2 Origin, evolution and taxonomical hierarchy of insects in animal kingdom	1
	1.3 Benefits and harms of insects: insect ledger	1
2.	External morphology	
	2.1 Insect body regions-head, thorax and abdomen	1
	2.2 Insect cuticle, sclerites and external processes	1
	2.3 Head: Segmentation, structure, modifications	1
	2.4 Insect mouth parts and their modifications	1
	2.5 Insect antennae and their modifications, photoreceptors (eyes)	1
	2.6 Thorax: Segmentation, structure, legs and their modifications, wing venation, and wing modifications	1
	2.7 Abdomen: Segmentation, structure, appendages, male and female genital organs	1
3.	Basic life processes and their physiology	
	3.1 Digestive and excretory system: feeding, digestion and excretion	1
	3.2 Reproductive system: male and female reproductive system	1
	3.3 Respiration and circulation: internal anatomy and physiology	1
	3.4 Nervous system: sense organs and nerve impulse transmission	1
	3.5 Bioluminescence and sound production in insects	1
	3.6 Insect metamorphosis and development	1
4.	Insect classification and preservation	
	4.1 Classification of insects: Introduction to insect orders, their characteristics and keys, taxonomic hierarchy	1
	4.2 Classification and characteristics of economically important families of insect orders – Thysanura, Odonata, Orthoptera, Dictyoptera, Isoptera	1
	4.3 Classification and characteristics of economically important families of insect orders – Isoptera, Mallophaga, Siphunculata (Anoplura)	1
	4.4 Classification and characteristics of economically important families of insect orders – Thysanoptera and Hemiptera	1
	4.5 Classification and characteristics of economically important families of insect orders – Siphonaptera, Coleoptera and Lepidoptera	1

	4.6 Classification and characteristics of economically important families of insect orders –Diptera and Hymenoptera	1
	4.7 Focus on major entomophagous insect orders	1
	4.8 Collection, killing, dry and wet preservation of insects	1
5.	Miscellaneous aspects of entomology	
	5.1 Introduction to industrial insects: bees, silkworms and lac insects	1
	5.2 Introduction to veterinary insects	1
	5.3 Insects of public health importance	1
	5.4 Insects of forensic and nutritional importance	1
	5.5 Recent advances, innovations and implications of entomology	1
	Total	30

B. Practical

S.N.	Topic	No. of Practical
1.	Study of microscope and the use of ocular and stage micrometers	1
2.	Dry and wet preservation of insects	1
3.	Body regions and major appendages of an insect	1
4.	Insect mouth parts of cockroach and plant bugs	1
5.	Insect mouth parts of butterflies/moths and honeybees	1
6.	Insect antennae and their modifications	1
7.	Insect legs and their modifications	1
8.	Insect wings and their modifications	1
9.	Insect dissection and study of insect systems (Digestive, reproductive, nervous, circulatory and respiratory)	1
10.	Insects that can be used as the food and feed	1
11.	Types of insect larvae and pupae	1
12.	Identification of important apterygote insects	1
13.	Identification of economically important exopterygote insects	1

14.	Identification of economically important endopterygote insects	1
15.	Identification of beneficial insects: major pollinators, predators and parasitoids	1
Total		15

REFERENCES

- Metcalf, C. L. and Flint, W. P. 1962. Destructive and Useful Insects, their Habits and Control. McGraw-Hill Book Company, Inc.
- Singh, R. 2004. Elements of Entomology. Rastogi Publications, Meerut, India.
- Pedigo, L. P. 2002. (4th ed.) Entomology and Pest Management. Prentice Hall of India Private Limited, New Delhi, India
- Borer, D. J., D. M. DeLong and C. A. Tripplehorn. 1976. An Introduction to the Study of Insects. Holt. Rinehart and Winston, Inc., New York, USA.
- Richards, O. W., and R. G. Davies. 1977. IMM's General Textbook of Entomology. Vol. I and II. Chapman and Hall, London

Course Code: HRT 111

Course Title: Fundamentals of Horticulture

Credit Hours: 3(2+1) Full Marks: 75 Theory: 50 Practical: 25

Objectives

The students will know basic knowledge and skills on general horticulture after completion of this courses.

Syllabus

This course focuses on the introduction to horticulture, horticultural crop classification, plant propagation of horticultural crops, agro-ecological zone and niches, growth and development of horticultural crops and factors affecting, horticultural enterprises and orchard establishment and management, plant growth regulators.

Course Breakdown

Theory

SN	Topic	Lectures
1.	Meaning of horticulture, its branches and its relation with other disciplines	1
2.	Importance, scope, present status, and national policy for horticultural development in Nepal along with major constraints	1

3.	Importance and prospects of organic horticulture crop production in Nepal	1
4.	Importance and prospects of indigenous horticultural plants and their role in nutritional and food security in Nepal	1
5.	Classification of horticultural crops:	
5.1	Botanical based classification of horticultural crops	1
5.2	Horticultural based classification of horticultural crops	1
6.	Agro-ecological zoning and niches from horticultural prospective in Nepal	1
7.	Factors affecting horticultural crop production	
7.1	Various environmental stress (Moisture, temperature, light, flood and salt)	1
7.2	Measures to overcome them	1
8.	Horticultural enterprises: Orchard, nursery raising, ornamental gardening, vegetable farming, postharvest handling operations and use preservations	2
9.	Orchard establishment and management:	
9.1	Site selection and layout of orchard	1
9.2	Planting, soil and water management, wind break and shelter	1
9.3	Manure and fertilizer, weed management, and intercultural operations	1
10.	Basics of plant propagation:	
10.1	Introduction, sexual and asexual propagation	1
10.2	Cutting and layering	1
10.3	Budding and grafting	1
10.4	Specialized vegetative parts, micro and mist propagation	1
11.	Growth and development:	
11.1	Concept of growth, development, and dormancy	1
11.2	Germination and juvenility	1
11.3	Maturity, flowering, fruit set, fruit growth and development	1
11.4	Unfruitfulness & fruit drops and their remedies	1
11.5	Ripening, tuber, rhizome and bulb development, senescence	1
12.	Plant growth regulators:	
12.1	Major classes of plant growth substances (Auxin, Gibberellins, Cytokinins, Ethylene and Inhibitors) and their functions	2
12.2	Commercial use of PGRs in horticulture	1
13.	Training and pruning:	
13.1	Principles and objectives of training and pruning	1
13.2	Different methods and their application in horticulture	1
14.	Cropping systems: High density planting, multi-storied cropping and multiple	1

	cropping in horticultural crops	
15.	Principles of urban & peri-urban horticulture, verticulture, hydroponics, aeroponics and river bed farming	1

Practical

SN	Topic	Lectures
1.	Mapping of Nepal in terms of agro-climatic zones and depict regions for growing major horticultural crops	1
2.	Identification of seasonal fruits, vegetables, spices and ornamental plants	1
3.	Identification of horticultural tools and equipment; manures and fertilizers; hormones and micronutrients	1
4.	Orchard layout for different system of fruit planting	1
5.	Preparation of pit for planting fruit saplings	1
6.	Propagation practice in seasonal horticultural plants: seed	1
7.	Propagation practice in seasonal horticultural plants: cutting	1
8.	Propagation practice in seasonal horticultural plants: layering	1
9.	Propagation practice in seasonal horticultural plants: Grafting	1
10.	Propagation practice in seasonal horticultural plants: Budding	1
11.	Training practices in seasonal horticultural plants	1
12.	Pruning practices by different methods	1
13.	Preparation and application of bordeaux formulation	1
14.	Project developed on horticultural enterprises	1
15.	Visit to Horticultural farm at local level	1

References

Acquaah, G. 2019. Horticulture: principle and practices. Pearson, USA. 816 p.

Bal, J.S. 1990. Fruit growing. Kalyani Publishers, India.

Hartmann., H.T., Kester, D.E., Davies, F.T. and Geneve, R.L. 2009. Plant propagation: principles and practices (7th Ed.). PHI Learning Private Limited, New Delhi. 880 p.

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Shrestha, G. K., S. M. Shakya, D. R. Baral and D. M. Gautam. 2001. Fundamentals of horticulture. IAAS, Rampur, Chitwan, Nepal.

Course Code: AGR 111

Title of the Course: Fundamentals of Agronomy

Credit Hours: 3 (2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVE

This course will help the students to understand the effect of various factors affecting the crop performance and the agronomical requirements for profitable crop production.

1. SYLLABUS

Introduction to Agriculture and Agronomy, Climate and Weather, Tillage, Plant Propagation and Planting Materials, Cropping System, Soil Erosion, Soil fertility and Productivity, Weed, Irrigation and Drainage, Plant Population.

2. COURSE OUTLINE

a. Theory

S.N.	Topic	No. of Lectures
1	Introduction to Agriculture and Agronomy	3
	1.1. Definition of Agriculture, Origin, History and Developmental Phases. Green Revolution.	
	1.2 Definition of Agronomy. Branches of Agriculture and their relation with other sciences. Role of agronomy in food security of Nepal.	
	1.3 Classification of crops based on cropping season, agronomic classification and classification based on purpose.	
2	Climate and Weather	2
	2.1 Agriculture as a climate dependent enterprise. Definition of climate,	

	weather, meteorology, agrometeorology. Microclimate modification. Weather forecasting.	
	2.2 Components of Climate and its effect on crop production. Solar radiation, temperature, relative humidity, wind and precipitation.	
3	Tillage	3
	3.1 Definition of tillage, history, modification of tillage practices over the time, objective of tillage, soil tilth, role of tillage in better crop establishment.	
	3.2 Classes of Tillage. Primary, Secondary, Tertiary. Effect of tillage on various soil properties.	
	3.3 Types of Tillage: Conventional tillage and Conservation tillage, their advantages and disadvantages.	
4	Plant Propagation and Planting Materials	4
	4.1 Plant Propagation. Sexual and Asexual Method of Plant Propagation along with their advantages, disadvantages and uses.	

	4.2 Definition of Seed, Quality seed and Seed Technology. Components of quality seeds and their importance.	
	4.3 Seed Germination, Seed Dormancy, Seed Vigor, Seed Viability. Methods to improve seed performance on the field.	
	4.4 Seed Certification. Importance. Seed certification methods in Nepal.	
5	Cropping System	2
	5.1 Definition of crop, cropping system, cropping pattern, cropping scheme, sole cropping, mono culture, farming system, multiple cropping (sequential, inter, mixed, relay). Crop Rotation and Its importance.	
	5.2 Calculation of Cropping Index, Cropping Intensity, Land Equivalent Ratio. Significance of these calculation. Dominant cropping systems in Nepal and their current issues (Rice and Maize based cropping system).	
6	Soil Erosion	2
	6.1 Erosion: Concept, Types, Causes and Issues in Nepal	
	6.2 Consequence of Erosion on crop production and methods for erosion management.	
7	Soil Fertility and Productivity	5
	7.1 Soil as the media for plant growth and development. Soil fertility, Soil Productivity, Essential Nutrients; classification and forms used by plants.	
	7.2 Manures: Definition, Types, Sources, Advantages and Disadvantages.	
	7.3 Fertilizers: Definition, Types, Sources, Advantages and Disadvantages.	
	7.4 Biofertilizer: Introduction, Types, working mechanisms.	
	7.5 Nutrient management in field: Manure application methods, fertilizer application methods, time of application and factors affecting fertilizer efficiency.	
8	Weed	3
	8.1 Weed: Introduction, Crop-Weed Interaction, Advantages and Disadvantages of Weeds	
	8.2 Classification of weeds, Management of Weeds (Physical, Cultural,	

	Biological)	
	8.3 Management of Weeds (Chemical), Integrated Weed Management	
9	Irrigation and Drainage	4
	9.1 Water: Role in plant system and in agriculture, Water Requirement, Irrigation: Definition and Types of irrigation.	
	9.2 Irrigated Vs Rainfed Agriculture. Issues with Rainfed Agriculture. Status of irrigation in Nepal.	
	9.3 Scheduling of Irrigation. Methods of irrigation scheduling: Critical stage approach, Soil moisture depletion approach, Evaporimeter approach.	
	9.4 Waterlogging and its consequence. Drainage: Importance and Types.	
10	Plant Population Maintenance	2
	10.1 Plant Population, Crop Density, Optimum plant population. Role of plant population and its importance in agriculture.	
	10.2 Crop Density, factors affecting crop density and response of plant to cropping density.	
TOTAL		30

b. Practicals

S.N.	Topic	No. of Practical
1	Identification of different tools and equipment available in Agronomy Lab.	1
2	Identification of different manures and fertilizers available in Agronomy Lab.	1
3	Identification of different herbicides, fungicides available in Agronomy Lab.	1
4	Identification of Weeds of various crops. Preparation of weed herbarium.	1
5	Identification of Seeds of various crops. Preparation of seed catalogue.	1
6	Visit to College Farm, Land Preparation and Planting of seasonal crops.	1
7	Calculation of Cropping Index, Cropping Intensity, Land Equivalent Ratio.	1
8	Calculation of fertilizer doses.	1
9	Calculation of seed rates.	1
10	Calculation of herbicide rates.	1
11	Demonstration of crop planting (seeding, transplanting) methods and fertilizer application methods (Broadcasting, Line (band) Placement, Point placement, Ring placement, Top dressing, Foliar application)	1
12	Identification of various sprayers, their parts and demonstration of spraying methods (with different nozzles too).	1
13	Quality seed assessment (Calculation of Seed Purity, Germination and Moisture).	1
14	Yield estimation of seasonal crops.	1
15	Visit to nearby farms, research stations (study the cropping system, varieties used, technology adopted, crops grown, cropping techniques, harvesting methods etc).	1
TOTAL		15

References

1. Reddy, T.Y. & Reddy, G.H. 2016. Principles of Agronomy. Kalyani Publisher. New Delhi.
2. Reddy, S.R. 2019. Principles of Agronomy. Kalyani Publisher. New Delhi.
3. Acquaaah, G. 2004. Principles of Crop Production: Theory, Techniques and Technology. Second Edition. Pearson.
4. De, G.C. 2019. Fundamentals of Agronomy. Second edition. Oxford and IBH Publishers. , New Delhi.

Course Code: SSC 111

Course Title: Fundamentals of Soil Science and Geology

Credit Hours: 3(2+1)

Full Marks: 75

Theory: 50

Practical: 25

OBJECTIVES

Upon the completion of this course, the students will be able to understand formation and properties of soils, and comprehend soil from ecological perspectives in relation with geology and climate.

I. SYLLABUS

Definition and concept of soil, historical development of soil science, ecosystem services and functions of soil and soil as a natural body; soil formation process and factors affecting soil formation, soil physical properties; soil chemical properties: soil pH, soil colloids and ion exchange phenomena; geology in relation to soils; soil ecology: the ecosystem, soil animals, nutrient cycling, soil organisms and environmental quality, soil health and soil quality.

II. COURSE OUTLINE

A. Lecture

S. N.	Topic	No. of Lectures
1.	Introduction of Soil Definition and concept of soil, Soil as a natural and three dimensional dynamic bodies, ecosystem services and functions of soil Pedological and Edhaphological approach of soil study Soil pedosphere; Soil profile and horizons Historical development of soil science, Branches of soil science	1 1 1 1
2	Soil formation 2.1 Process of soil formation: basic and pedogenic 2.2 Soil forming factors	1 1
3	Soil physical properties	

	<p>3.1 Soil Texture: soil separates, soil textural classes and use of soil textural triangle, Stoke's law and specific surface area of soil separates, importance of soil texture in crop production</p> <p>3.2 Soil structure: types of soil structure, Grades soil structure, soil aggregates and aggregate formation process, Factors affecting soil aggregate formation, importance of soil structure in crop production</p> <p>3.3 Soil color: Munsell color chart, measurable variable of color, factors affecting soil color, importance of soil color</p> <p>3.4 Soil density: Particle density and Bulk density, factors affecting the particle density and bulk density and their importance</p> <p>3.5 Soil porosity: Types of soil pores, factors affecting soil porosity, importance of soil porosity</p> <p>3.6 Soil consistency: Soil consistency at various moisture levels</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>
4	<p>Soil chemical properties</p> <p>4.1 Soil pH</p> <p>4.1.1 Concept of soil pH; role of soil pH on nutrient availability in soil</p> <p>4.1.2 Soil acidity: Causes of soil acidity, types or pools of soil acidity, management of acidic soils, buffering capacity of soils, soil acidity issues in Nepal and their management.</p> <p>4.1.3 Soil alkalinity: causes of soil alkalinity, measuring salinity and sodicity, classes of salt affected soil, management of saline and sodic soils, soil alkalinity issues in Nepal and their management.</p>	<p>1</p> <p>2</p> <p>1</p>
	<p>4.2 Soil colloids</p> <p>4.2.1 Properties of Soil Colloids and its types, genesis of soil colloids</p> <p>4.2.2 Silicates clay structure (Neosilicates, Inosilicates, Phyllosilicates and Tectosilicates),</p> <p>4.2.3 Layer silicate (Phyllosilicates) clays structure and its types of structure</p> <p>4.2.4 structural characteristics of non-silicate colloids, sources of charges on colloids</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p>
	<p>4.3 Ion Exchange Phenomena</p> <p>4.3.2 Cation exchange and Anion exchange: Adsorption of cations, Principles of cation exchange reactions, cation exchange capacity, cation saturation and nutrient availability</p> <p>4.4.3 Anion exchange: Adsorption of anions, principles of Anion exchange, anion exchange capacity and its importance in agriculture</p>	<p>1</p> <p>1</p>
5.	<p>Rocks and minerals</p> <p>5.1 Rocks: formation of rocks, types of rocks; soil forming minerals: types</p>	<p>2</p>

	of minerals	
	5.2 Weathering of rocks and minerals: types of weathering, factors affecting weathering; major weathering process in different physiographic regions of Nepal	1
	5.3 Physiographic regions of Nepal and their geology	1
6.	Ecology of soil organisms:	
	6.1 Diversity of soil organisms in soil, Abundance and microbial activity of soil organisms	1
	6.2 Importance of soil organisms in soil fertility, productivity and environment quality, producers, consumers and decomposer	1
7.	Soil health and soil quality	
	Concept and indicators of soil health and soil quality	1
	Soil resistance and resilience to climate change; climate change impacts on soil	1
	Total	30

B. Practical

S. N.	Topic	No. of Practical
1.	Identification and function of laboratory equipment used in soil lab.	1
2.	Collection and Preparation of soil sample	1
3.	Soil textural determination by Feel method	1
4.	Soil consistency determination	1
5.	Particle size analysis by hydrometer method	2
6.	Soil structure determination	1
7.	Determination of soil color	1
8.	Determination of bulk density of soil	1
9.	Determination of Particle density of soil	1
10.	Determination of soil pH	1
11.	Determination of lime requirement in acid soil	1
12.	Identification of soil forming rocks and minerals	1
13.	Isolation of fungi and bacteria from soil	1
14.	Study of soil profiles under different land use systems	1
Total		15

Text Books

1. Brady, N. C., & Weil, R. R. (2014). *The Nature and Properties of Soils*. Pearson. United Kingdom.
2. Mehra, R. K. (Ed.) (2011). *Textbook of Soil Science*. ICAR, India.
3. Ray, S. K., Bhattacharyya, T., Chandran, P., & D C Nayak, D. C. (2023). *Fundamentals of Soil Science*. Biogreen Books, India.
4. Thompson, B. (2022). *Fundamentals of Soil Science*. Bookfort. ISBN 9781839370847.

REFERENCES:

1. Bottomley, P. J., Angle, J. S., Weaver, R. W. (Eds.). (2014). *Methods of Soil Analysis, Part 2: Microbiological and Biochemical Properties*. Wiley Publications.
2. Dane, J. H., Topp, C. G. (Eds.). (2018). *Methods of Soil Analysis (Part 4): Physical Methods*. Soil Science Society of America/Wiley Publication.
3. Giri, B., & Varma, A. (2020). *Soil Health*. Springer.
4. Hamon, A. (2021). *Introduction to Soil Microbiology*. Oxford Book Company. India. ISBN 9789350306628.
5. Karlen, D. L., Stott, D. E., Mikha, M. M. (Eds.). (2021). *Soil Health Series Volume 1: Approaches to Soil Health Analysis*. Soil Science Society of America.
6. Khan, A., & Chaudhary, K. (2018). *Laboratory Manual of Microbiology and Soil Science*. Arcler Education Inc. ISBN 9781773613352.
7. Millar, C. E., & Turk, L. M. (2002). *Fundamentals of Soil Science*. Biotech Books. India.

8. Richards, C., & Gaurav, S. S. (2015). *Handbook of Soil Genesis and Classification*. Saujanya Books. India. ISBN 9789384556099.
9. Sparks, D. L., Page, A. L., Helmke, P. A., Loeppert, R. H. (Eds.). (2020). *Methods of Soil Analysis (Part 3): Chemical Methods* (1st ed.). ACSESS Publication.

Course Code : BSC 111

Course Title : Fundamentals of Plant Biochemistry

Credit Hours : 3 (2+1)

Full Marks: 75

Theory: 50

Practical: 25

OBJECTIVES

Upon the completion of this course, the students will be able to understand the basics of biochemistry which includes the structures, functions and metabolism of major biomolecules.

SYLLABUS

Introduction, concepts, importance, pH, buffer, structures, functions and classifications of major biomolecules, biosynthesis and degradation of biomolecules, central metabolic pathways and their significance

COURSE OUTLINE

A. Lecture

S.N. Topic	No. of Lecture
<hr/>	
1. Introduction	
1.1. Concepts, scope, importance and application of plant biochemistry	1
1.2. Structure of water, its importance in biological reactions	1
1.3. pH and buffer with their applications	1
2. Biochemistry of carbohydrates	
2.1. Definitions, classification and functions of carbohydrates	1
2.2. Structure and source of monosaccharides and disaccharides	1
2.3. Structure and source of cellulose, chitin, and starch	1
2.4. Isomerism and reactions of monosaccharides	1
3. Biochemistry of amino acids and proteins	
3.1. Definition, functions and structure of standard amino acids	1

3.2. Classification of standard amino acids	1
3.3. Properties of amino acids and their importance in plant metabolism	1
3.4. Definitions, classification and functions of proteins	1
3.5. Structural organization of proteins and their significance	1
4. Biochemistry of Lipids	
4.1. Definition, types and structure of fatty acids, essential fatty acids and their roles	1
4.2. Definition, functions, structures and classification of lipids	1
5. Biochemistry of Nucleic acids	
5.1. Structure and functions of nitrogenous base, nucleoside and nucleotides	1
5.2. Structure and functions of DNA	1
5.3. Structure and functions of RNA	1
6. Enzymes	
6.1. Introduction, properties and classification of enzymes	1
6.2. Factors affecting enzyme activity	1
6.3. Mechanism of enzyme action	1
6.4. Enzyme inhibition, types and its significance in plant metabolism	1
7. Carbohydrate metabolism	
7.1. Biosynthesis of sucrose and starch in plants	1
7.2. Glycolysis: types and role in plant metabolism	1
7.3. TCA cycle and its role as central metabolic pathway	1
7.4. Electron transport chain system of mitochondria and its inhibitors	1
8. Amino acid and protein metabolism	
8.1. Reactions of amino acids: Transamination & deamination	1
8.2. Decarboxylation reactions, Peptide bond and their importance	1
8.3. Biosynthesis of protein and its importance	1
9. Lipid metabolism	
9.1. Biosynthesis of Triacyl glycerol and its role in plant metabolism	1
9.2. Beta oxidation of fatty acids with reference to palmitic acid	1

B.Practical

S.N.	Topic	No. of Lecture
1.	Introduction and use of laboratory equipments and glass wares	1
2.	Preparation of standard solutions: normal, molar and percentage solution	1
3.	Preparation of buffer solutions and determination of pH	1
4.	Qualitative tests of carbohydrates	2
5.	Qualitative estimation of amino acids	1
6.	Qualitative estimation of protein	2
7.	Precipitation reactions of proteins	1
8.	Qualitative estimation of lipids	1
9.	Quantitative estimation of carbohydrates	1
10.	Quantitative estimation of amino acids and proteins	1
11.	Demonstration of spectrophotometer and colorimeter	1
12.	Demonstration of paper and thin layer chromatography	1
13.	Demonstration of centrifugation methods	1

Total 15

REFERENCES

Lehninger, A. L. 1975. Principle of Biochemistry. Kalyani Publishers New Delhi, India.

Well, J. H. 1990 General Biochemistry. Wiley Eastern Ltd. New Delhi.

Conn, E. E., P. K. Stumpf. G. Bruening and H. D. Roy. 1987 Outlines of Biochemistry. John Wiley & Sons, New York.

Shakya, L., S. Sapkota, S. Khanal. 2017. Textbook of biochemistry. Makalu Publication House, Kathmandu, Nepal.

Course Code: ASC 111

Course Title: Fundamental of Livestock Production and Management

Credit Hour: 3 (2+1)

Full Mark: 75

Theory: 50

Practical: 25

Objectives

The aim of this course is to teach the students about fundamentals of livestock and poultry industry; key management practices, prevention and control measures of commonly occurring diseases and parasites of livestock and poultry.

Syllabus

Importance, scope of livestock and poultry in Nepal. Zoological classification of farm animals and birds, breed characteristics, Differences between ruminant and non-ruminant. Commonly used terms of animal husbandry. Common management practices such as, Ageing, weighing, identifications, Animal restraining and handling. Marketing and transportation. Sign of health and diseases. Care and management of sick animals. Control and prevention of major diseases and parasites. Importance of barn sanitation and waste handling. Farm records.

Outline

Theory

SN	Title	Lecture
1	Importance of livestock and poultry production	1
2	Overview and challenges in livestock and poultry farming in Nepal	1
3	Key terminologies related to livestock and poultry production	1
4	Zoological classification of farm animals and poultry	2
5	Breed characteristics of important breeds: Cattle, buffalo, goat and Sheep (Jersey, Holstein Friesian, Brown Swiss, Achhami, Lulu, Yak/Nak, Chauri, Red Sindhi, Sahiwal and Hariana), buffalo (Murrah, Nili Ravi, Jafrabadi, Tarai, Lime and Parkote), sheep (Bhyanglung, Baruwal, Kage, Lampuchhre, Merino, Rambouillet and Polworth.) and goat (Jamunapari, Barbari, Black Bengal, Beetal, Boer, Saanen, Khari, Tarai, Sinhal and Chyangra)	2
6	Breed characteristics of important breeds of Pig and poultry (Chwache, Bampudke, Hurrah, Hampshire, Landrace, Duroc and Yorkshire) and poultry (Cobb 500, New Hampshire, Leghorn, Australorp, Giriraj and Lohmann)	2
7	Differences between ruminants and non-ruminants' animal and their role in livelihood	1
8	Techniques for restraining and handling animals for health purposes, and methods for identifying farm animals	1
9	Methods of Identification of farm animals	1
10	Weighing and ageing of farm animals	1
11	Marketing and transportation of farm animals including poultry	2

12	Sign of health and diseases in farm animals	2
13	Care and management of sick animals	2
14	Care and management of newborn calf, kid and lamb	2
15	Care and management of newborn piglet	1
16	Classification of feeds and fodder	1
17	Feeding practices of farm animals	1
18	Importance of barn hygiene and waste management	1
19	Important farm records, their preparation and maintenance	1
20	Prevention and control of major diseases of livestock and poultry (H.S., B.Q., FMD, Brucellosis, Ranikhet, Fowl pox, Coccidiosis, Gumboro, Marek's, Swine fever and Porcine Reproductive and Respiratory Syndrome (PRRS))	2
21	Prevention and control of major parasites of livestock and poultry (Ticks, Lice, Fleas, Liver fluke, Ascariasis and Tape worm)	2
	Total	30

Practical

SN	Topic	Lecture
1	Identification of external body parts of cattle, buffalo, sheep, goat, pig, poultry	1
2	Study of livestock housing system	1
3	Study of body temperature, respiration rate and pulse rate	1
4	Cleaning and disinfection of the animal barn	1
5	Ageing of farm animals (Cattle, Buffalo, Sheep, Goat and Swine)	1
6	Estimation of body weight by body measurement	2
7	Identification of different farm animal and poultry breeds	2
8	Numbering of farm animals and birds	2
9	Study of different types of farm records	1
10	Handling and casting of farm animals	1
11	Identification of feed ingredients and fodders	2
	Total	15

References

- Banerjee, G.C. 2013. A text book of animal husbandry (8th ed.). Oxford and IBH Pub., India.
- Damron, W.S. 2012. Introduction to animal science: global, biological, social and industry prospective (4th ed.). PHI Learning Pvt. Ltd., India.

Course Title: Rural Sociology and Educational Psychology

Course Code: EXT 111

Credit Hour: 3 (2+1)

Full Marks: 75

Theory: 50

Practical: 25

OBJECTIVES:

Upon the completion of this course, students will understand the sociological and psychological aspects of rural people, the important features of rural society, and their application in the field of agricultural development and the extension of the education system.

I. SYLLABUS

Rural sociology- meaning, nature, scope, origin and development, rural-urban continuum, importance social values and attitudes, Nepalese rural society, rural-urban continuum, social groups, social process, social movement, social change, social stratification, social mobility, rural dynamics, traditional caste systems in rural societies, social institution, socialization, social exclusion, social deviance, social problems and remedies, social control, leadership, educational psychology, concepts of learning, effective teaching-learning elements, basic psychological concepts, personality, and motivation.

II. COURSE OUTLINE

S.N.	Title	No. of Lecture
1.	Rural sociology: meaning, nature, scope, importance in Nepalese context and relationship of rural sociology with other social sciences	1
2.	Origin and development of rural sociology, differences and relationship between rural and urban societies, Rural-urban continuum	1
3.	Nepalese rural society: characteristics; cultural concepts, culture, customs, folkways, mores, taboos, rituals and traditions: meaning, definition and their role in agricultural extension.	1
4.	Social values and attitude: meaning, definition, types, and role of social values and attitudes in agricultural extension	1
	Social groups: Meaning, types of social groups, stages of group formation, and factors affecting group formation	1
5.	Process of social interaction: Accommodation, Adjustment, Amalgamation, Assimilation, Cooperation, Consensus, Competition, Conflict, and Integration	2
6.	Social movement: meaning, definitions, causes, and Theories of social movement: a. psychological theories: Discontent theory and personal maladjustment theory, b. sociological theories: Relative deprivation theory and resource mobilization theory	1

7.	Social change: meaning, factors of social change, and theories of social change: a, Evolution theory b, Cyclical theory c, Conflict theory	1
8.	Social stratification: meaning and bases (class, caste, ethnicity, power, gender)	1
9.	Social mobility and dynamics of emerging identity, Rural dynamics: migration	1
10.	Traditional caste system and their occupation in Rural Nepal	1
11.	Social institutions: family and its type, marriage system a, Social institution: household, family, marriage b, Economic institutions: meaning, types, and function c, Educational institutions: types and function d, Religious institutions: Meaning, types of religion, function/dysfunctions, and followers e, Political institutions: state and its elements, function	3
12.	Socialization: Concept, meaning, definitions, stages, agents, and theories of socialization: a. Cooley's theory of looking-glass self, b. Mead's theory of self, and Freud's theory of the human mind	2
13.	Social exclusion: Origin and development of the concept of social exclusion, paradigms, and domain (gender, ethnicity, class, and caste) of social exclusion	2
14.	Social deviance: Meaning, definitions, types, theories and mechanisms	1
15.	a. Social problems and means of remedies b. Social control: Meaning, definitions, types, and theories	1
16.	Leadership: meaning, classification, function, qualities of a good leader, and role of local farm leader in agricultural development	1
17.	Education, psychology, educational psychology, social psychology: definitions and importance in agricultural extension	1
18.	Concepts of learning: three learning domains, types of learners: theorist, pragmatist, reflectors, and activist. Learning cycle, learning theories: four learning theories and Thorndike's four laws of learning	2
19	Effective teaching-learning elements. Factors affecting the effective teaching-learning situation	1
20.	Basic psychological concepts; intelligence, personality, motivation,	1

	emotions, attitudes, and social perception	
21.	Personality: traits, types, and measurement. Factors influencing the personality, Motivation: significance, techniques; perception: determinants, errors; attitudes: factors influencing the development of attitudes	2
22.	Roles of personality, motivation, attitudes, and perceptions in agricultural extension	1
	Total	30

Practical

S.N.	Topic	No. of Practical
1.	Study of urbanization as a phenomenon influencing rural areas.	1
2.	Study globalization as a phenomenon influencing contemporary agriculture practices in Nepal.	1
3.	Visit rural communities to study the characteristics of rural society.	1
4.	Visit a rural community to identify different social groups associated with the farmers.	1
5.	Visit rural communities to list out the taboos, folkways, rituals, and social values related to farming.	1
6.	Visit a village to conduct the selection of a leader (based on the sociogram technique).	1
7.	Proposal development on a study of rural social institutions and organizations (Group exercise: students will develop a proposal)	
	a. Steps of the proposal: selection of rural social institution, introduction, statement of problems, objectives, literature review, research methods	2
	b. Techniques of data collection (Observation, interview, questionnaire, and document analysis)	2
	c. Data processing and analysis: Data editing, coding, entry, and analysis techniques.	2
8.	Report writing: Type of report, steps of report writing (Group exercise: student will prepare a report based on their data collection).	2
9.	Presentation of the report (Group exercise: students will present their report and prepare a final draft report).	1

References;

1. Bhusan, V. and D. R. Sachdeva 2012. Fundamentals of Sociology. Pearson, New Delhi, India.
2. Chitamber, J. B. 1973. Introductory Rural Sociology. Wiley Eastern Limited, India.
3. Harlambos and Holborn 2014. Sociology: Themes and perspectives (8th Edition). London, Harper-Collins.
4. Horton, P.B. and Hunt, C.L. 2004. Sociology. New Delhi: Tata McGraw-Hill Publishing Company Ltd.
5. Rao, S.C. N. 2005. Sociology: Principles of Sociology with an Introduction to Sociological Thought. S. Chand and Company Ltd.: New Delhi.
6. Rao, U. 2008. Advanced Educational Psychology, Himalaya Publishing House, New Delhi.
7. Regmi, R.R. 2001. The essentials of sociology. Published by Sandeep Raj Regmi, Kath.

Second semester courses

Course Code: AEC122

Course Title: Farm Management and Production Economics

Credit Hours: 2+1 **Full Marks:** 75 **Theory:** 50 **Practical:** 25

Objective

The overall objective of the course is to train and develop the capacity of students in the various aspects of farm management, production economics, and effective and efficient ways of managing the farming business.

Syllabus

The course focuses on the scope and importance of farm management, farm resource management, the concept and scope of agricultural production economics, principles in farm management decisions, linear programming, sources and management of agricultural risk and uncertainty, farm planning and budgeting, farm business analysis (farm records and accounts, depreciation of farm assets, farm inventory, net worth statement, and farm efficiency), and the development of a farm business plan.

Course Breakdown

Theory

S.No.	Topic	No of Lectures
1	Scope and importance of farm management, relationships of farm management with other sciences, and farm management decisions	2
2	Farm resource management: land management, labor management, and capital management	2
3	Production economics: concept of agricultural production economics, production function, law of diminishing marginal returns, stages of production function and the optimum level of production, and Cobb-Douglas production function and its application	4
4	Production relationships: factor-product relationship, factor-factor relationship, product-product relationship	2
5	Principles in farm management decisions: law of variable proportions, principle of factor substitution, principle of product substitution, cost principle, principle of opportunity cost, time comparison principle (time value of money), and law of equi-marginal returns	4
6	Linear programming: definition, assumptions and elements of linear programming, and application of linear programming	2
7	Risk and uncertainty in agriculture: sources of agricultural risk, risk prioritization and estimation, and risk management strategies	2
8	Farm planning and farm budgeting: scope and importance of farm planning	2

	and budgeting, types of farm budgeting, and characteristics of a good farm plan	
9	Farm records and accounts: definition and importance of farm records and accounts, types of farm records and accounts, and application of farm records and accounts	2
10	Depreciation of farm assets: definition and methods of computing depreciation	
11	Farm inventory: purpose and process of making farm inventory	1
12	Net worth statement: assets and liabilities and estimation of the net worth	2
13	Income statement: concept, cash flows, preparation and application of the income statement	1
14	Farm efficiency measures: net worth analysis, liquidity analysis, solvency analysis, and profitability analysis	2
14	Business plan: scope and importance of a farm business plan, and structure of a business plan	2
	Total	30

Practical

S.No.	Topic	No of Practical
1	Estimation of the optimum point of production (factor-product relationship)	1
2	Estimation of the least-cost combination of two inputs	1
3	Estimation of the optimum combination of two enterprises	1
4	Time value of money: application of discounting and compounding techniques	1
5	Application of linear programming: a graphical approach	1
6	Identification and management of risk for a selected enterprise	1
7	Budgeting for a selected agricultural enterprise	1
8	Estimation of the depreciation of farm assets	1
9	Preparation of a farm inventory	1
10	Preparation of an income statement for a farm	1
11	Preparation of a net worth statement for a farm	1
12	Estimation of the efficiency of a farm	1
13	Visit nearby farms and discuss practical issues associated with the management of the agricultural enterprises (preparation of a report)	3

	Total	15
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References

7. Johl, S.S. and T.R. Kapoor. 2009. Fundamentals of Farm Business Management. Kalyani Publishers, New Delhi.
8. Shankhyan, P.L. 1983. Introduction to Farm Management. Tata. McGraw-Hill, Co Ltd. New Delhi.
9. Debertin, D.L. 2002. Agricultural Production Economics. University of Kentucky.
10. Kay, RD. and W M. Edwards 1994. Farm Management. McGraw Hill, Inc., New Delhi.
11. S.C. Panda, S.C. 2007. Farm Management and Agricultural Marketing. Kalyani Publishers, New Delhi

Course Code: ASC 122
Course Title: Animal Nutrition, Range land and Forage Science
Credit Hours: 3(2+1) Full Marks: 75 Theory: 50 Practical: 25

Objectives

Upon the completion of the course students will be able to understand the basic principles of animal nutrition, feeds and forage/pasture and will be able to recognize the function and deficiency symptoms of nutrients, feed requirements and cultivation and utilization of major fodder and pasture species.

Syllabus

Role of Animals nutrition in Animals husbandry and its scope in Nepal. Comparative composition of plant and animal cells and tissues. Feed stuffs and their nutrition content with utilization characteristics functions and classification of carbohydrates,protein,lipid and fats function of water in animals body characterizes and nutritional imporatnces of minerals and vitamins feed additives and their role. Digestion, absorption and metabolism and various nutritents ruminants non ruminants and birds feeding standard in different species and age group of animals. Introduction; terminology of fodder and pastures. Climate and soil types. Factors affecting chemical composition and nutritive value of fodder. Fodder plant growth development and yield: morphology of forage grasses. Principle of grass seed production. Cultivation practices of common annual and perennial fodder legumes and grasses. Common pasture species and their management. Pasture establishment, cultivated seed beds and nutrition of grazing animals. Pasture and soil fertility. Preservation and conservation: hay and silage making. Silvi-pastoral system and other alternatives and their importance.

UNIT	TOPICAL BREAK DOWN	NO. OF LECTURE
Section A: Principles of Animal Nutrition		

1	History and importance of animal nutrition, Composition of plant and Animal cell, Principle of feed classification	1
2	Energy measurements, metabolism of carbohydrates, protein and fat, and water, functions and deficiency symptoms	1
3	Metabolism of minerals and vitamins, classifications and functions and deficiency symptoms	1
4	Antagonisms and synergisms of nutrients (minerals and vitamins)	1
5	Digestion physiology of ruminants and non-ruminants	1
6	Regulation of feed intake,	1
7	Classification of feed additives and supplements	1
Section B: Forage Science		
8	Introduction; feeds and feeding situation in Nepal; common terminology of fodder and pasture, Factors associated with fodder production (biotic and abiotic), growth, morphology and development	1
9	Principle of grass seed production, Reproductive development. Component of seed yield, and Actual seed yield	1
10	Cultivation practices of common annual and perennial fodder/grasses and legumes: Oats, Jawar, Bajra, Teosinte, Maize, Napier, Blue panic, Siratro, Centrocema, Molases, Mulato, Berseem, Lucern, Joint vetch, Desmodium, Stylosanthes, Forage peanut, Butterfly pea, Glycine	3
Section C: Rangeland management		
11	Cultivation, establishment and yield of common pasture species: Perennial ryegrass, Cocksfoot, Tall fescue, Phalaris, white clover, Red clover, Lotus	1
12	Pasture establishment; seed quality, sowing, soil environment Cultivated seed beds and management of pasture Nutrition of grazing animals; nutritive value of pasture, herbage intake and composition, pasture and soil fertility and nutrient recycling, N fixation, grass legume mixtures	1
13	Preservation and conservation of fodder/forage(Hay and silage making) and silvipasture and forage alternatives, Hay making, steps, advantages and disadvantages, Silage making, process, steps, advantages and limitations	1
TOTAL		15

Practical

S.No.	Topic	No.of Practicals
1.	Sampling, identification of feed, fodder and pasture species for proximate analysis	1
2.	Identification of energy and protein rich feed ingredients.	1
3.	Identification of pasture and forage species.	1
4.	Determination of dry matter.	1
5.	Determination of ether extract.	1

6. Determination of crude fiber.	1
7. Determination of crude protein.	1
8. Determination of nitrogen free extract.	1
9. Determination of gross energy.	1
10. Feeding standard for cattle and buffalo.	1
11. Feeding standard for cattle and pig.	1
12. Feeding standard for cattle and birds.	1
13. Hay and silage making	1
14. Urea treatment of low-quality forages	1
15. Van Soest Method of Fiber Analysis	1
Total	15

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- Benerjee, G.C. 1986. A Text Book of Animals Nutrition
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- Church, D. C., & Pond, W. G. (1988). *Basic animal nutrition and feeding*. John Wiley & Sons.

Course Code : BSC 122

Course Title : Fundamentals of Crop Physiology

Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50

Practical: 25

OBJECTIVES

Upon the completion of this course, the student will understand physiological functions taking in the crop plants.

SYLLABUS

Introduction, cell physiology, Biophysio- chemical phenomenon, Absorption and translocation of water and minerals, Photosynthesis, Respiration, Translocation of Organicsolution, Growth and Development Plant Growth Regulators, Yield Attributing Charactersof Crops.

COURSE OUTLINE

Lecture

S.N.	Topic	No. of Lecture
1. Introduction		
1.1.	Definition, scope and importance in agriculture	1
2. Plant Cell physiology		
2.1.	Definition and ultra-structure of typical plant cell	1
2.2.	Structure and functions of cell organelles	1
3. Biophysio-chemical phenomenon		
3.1.	Laws of thermodynamics and their applications	1
3.2.	Diffusion and osmosis, their roles in crop physiology	1
3.3.	Concept of water potential and its application	1
4. Absorption and translocation of water and minerals		
4.1.	Absorption of water in plants and factors affecting water absorption	1
4.2.	Ascent of sap: concepts, mechanism and factors affecting ascent of sap	1
4.3.	Mineral absorption and translocation: site and different types of mechanism	1
4.4.	Transpiration: concepts, importance, types and factors affecting transpiration	1
4.5.	Types of stomata and mechanism of stomatal movement	1
4.6.	Importance of transpiration on plant physiology	1
5. Photosynthesis		
5.1.	Light dependent reaction of photosynthesis: pigment system I and II, cyclic and non-cyclic photophosphorylation	1
5.2.	Light independent reaction of photosynthesis and C ₄ cycle	1
5.3.	Crassulacean acid metabolism, and photorespiration	1
5.4.	Factors affecting rate of photosynthesis	1
5.5.	Phloem anatomy, phloem loading and unloading	1
5.6.	Translocation of photosynthates	1
6. Respiration		
6.1.	Concepts, types, and significance of respiration, respiratory quotient	1
6.2.	Glycolysis and its significance in plant physiology	1
6.3.	Kreb's cycle and its importance	1
1 6.4	Mitochondrial electron transport system and Oxidative phosphorylation	1

7. Physiology of growth and development

7.1. Definition, phases and course of growth and development	1
7.2. Seed germination and dormancy: concepts and types	1
7.3. Photoperiodism: concepts, plant types based on photoperiodic response, mechanisms of photoperiodism	1
7.4. Vernalization: concepts and site of vernalization, and physiological and biochemical changes during vernalization	1
7.5. Growth analysis: Physiological aspects of growth and development	1
7.6. Role of physiological growth parameters in crop productivity	1

8. Plant growth regulators

8.1. Definitions, classification, and physiological roles of Auxin	1
8.2. Physiological roles of Gibberellins & Cytokinin	1
8.3. Physiological roles of Ethylene, Abscisic acid	1

Total 30

Practicals

S.N.	Topic	No. of Practical
1.	Introduction and use of laboratory equipments and glass wares	1
2.	Demonstration of plasmolysis process using onion cell	1
3.	Study of the structure and distribution of stomata in monocot leaves	1
4.	Study of the structure and distribution of stomata in dicot leaves	1
5.	Study of the process of transpiration with the help of cobalt chloride paper, hotometer, and bell jar	1
6.	Demonstration of photosynthetic pigments by paper chromatography and calorimeter	1
7.	Study the factors affecting the process of photosynthesis	1
8.	Study the process of root pressure by exudation method and transpiration pull method	1
9.	Growth and analysis of field crops	1
10.	Study of the process of aerobic respiration and alcoholic fermentation	1
11.	Study of anatomy of C ₃ and C ₄ plant leaves	1
12.	To study the measurement of growth (height and weight)	1
13.	Effect of GA on different physiological processes (dormancy, germination, growth and flowering)	1
14.	Demonstration of osmosis process using potato tuber	1
15.	Field visit to different crop field for studying physiological aspect.	1
Total		15

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Devlin, R. M. and R.H. Witham. 1986. Plant Physiology . CBS Publication and Distribution, New Delhi, India.

Khanal, S., S. Sapkota and L. Shakya. 2017. Textbook of crop physiology. Makalu Pub., Nepal.

Jain, V. K. 1997. Fundamentals of Plant Physiology. S Chand and Co Ltd. New Delhi India
Kimball J. W. Biology. Addison. Wesley Publishing Company. (Chapters. 3, 6, 8, 9, 12 & 23)

Saxena, S. K. 1995. Modern Practical in Plant Physiology and Biochemistry. CBS Publications and Distribution, New Delhi, India.

Course Code: PLP 121

Course Title: Fundamentals of Plant Pathology

Credit Hours: 3 (2+1) Full Mark: 75 Theory: 50 Practical:25

Objective:

After completion of this course, students will be able 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).

Syllabus:

Introduction of major diseases causing organisms and plant diseases symptoms, general principles of plant pathology including epidemiology, survival, dissemination, physiology of infected plants, defense mechanism and general management practices.

Course Breakdown:

Theory:

S. No.	Topics	No. of Lectures
1.	Plant Pathology: Introduction, definition, objectives and importance	1
2.	History of plant pathology, Terms and concepts on Plant Pathology	1
3.	Causes of plant diseases: Biotic and Abiotic factors	1
4.	General symptoms and classification of plant diseases	1
5.	Fungi: Definition, importance, general morphological characters	1
6.	Fruiting bodies of plant pathogenic fungi: Sexual and Asexual	1
7.	Taxonomical classification of fungi with their diagnostic features	1
8.	Myxomycota: <i>Plasmodiophora</i> & <i>Spongospora</i>	1
9.	Mastigomycotina: <i>Pythium</i> , <i>Phytophthora</i> , <i>Albugo</i>	1
10.	Mastigomycotina: <i>Peronospora</i> , <i>Pseudoperonospora</i> , <i>Plasmopara</i> , <i>Bremia</i>	1
11.	Ascomycotina: <i>Protomyces</i> , <i>Taphrina</i> , <i>Erysiphe</i> , <i>Venturia</i> , <i>Claviceps</i> , <i>Sclerotinia</i>	1
12.	Basidiomycotina: <i>Puccinia</i> , <i>Uromyces</i> , <i>Hemileia</i> , <i>Melampsora</i> , <i>Ustilago</i> and <i>Tilletia</i>	1

13. Deuteromycotina: <i>Colletotrichum</i> , <i>Alternaria</i> , <i>Cercospora</i> , <i>Fusarium</i>	1
14. Deuteromycotina: <i>Helminthosporium</i> , <i>Pyricularia</i> , <i>Sclerotium</i> , <i>Rhizoctonia</i>	1
15. Definition, general morphology of bacterial cells and their functions	1
16. Classification, and characters of bacteria: <i>Xanthomonas</i> , <i>Pseudomonas</i> , <i>Erwinia</i> , <i>Agrobacterium</i> , <i>Corynebacterium</i> and <i>Streptomyces</i>	1
17. Definition, characteristics, and classification of viruses and viroids	1
18. Multiplication and transmission of virus	1
19. General characteristics, life cycle, and reproduction in Nematodes	1
20. Characteristics of <i>Anguina</i> , <i>Heterodera</i> , <i>Globedera</i> , <i>Meloidogyne</i> and <i>Hirshmanella</i>	1
21. Variability in Plant Pathogens (Fungi and Bacteria)	1
22. Pathogenicity and Pathogenesis	1
23. Survival and dispersal of plant pathogens	1
24. Epidemiology and forecasting of plant diseases	1
25. Effects of pathogens on plant physiological functions	1
26. Roles of enzymes and toxins in pathogenesis	1
27. Defense mechanism in plants: Pre-existing and Post infection	1
28. Principles & Methods of Integrated Plant Disease Management	1
29 Fungicides: Its classification, mode of action and uses	1
30. National legislation and authorities for plant disease management	1

Total	30

Practical:

S. No.	Topics	No. of Lectures
1.	Identification of laboratory equipments and chemicals available at plant pathology laboratory	1
2.	Field visit for the identification of parasitic and non-parasitic causes of plant disease	1
3.	Cleaning and sterilization of glassware and lab safety measures	1
4.	Identification of lower fungi based upon their morphological structures: <i>Pythium</i> and <i>Phytophthora</i> , <i>Peronospora</i> , <i>Pseudoperonospora</i> , <i>Albugo</i>	1
5.	Identification of higher fungi based on their morphological structures: <i>Protomyces</i> , <i>Erysiphe</i> , <i>Puccinia</i> , <i>Uromyces</i> and <i>Ustilago</i>	1
6.	Identification of Deuteromycetes fungi: <i>Alternaria</i> , <i>Cercospora</i> , <i>Colletotrichum</i> , <i>Fusarium</i> and <i>Trichoderma</i>	1
7.	Identification of Deuteromycetes fungi: <i>Helminthosporium</i> , <i>Pyricularia</i> , <i>Rhizoctonia</i> , <i>Sclerotium</i>	1
8.	Preparation of general media for the growth of fungi	1
9.	Isolation of fungi from soil and infected plant sample	1
10.	Extraction of nematodes from soil and infected plant sample	1

11.	Identification of pathogenic and saprophytic nematodes	1
12.	Preparation of general media for bacteria	1
13.	Isolation of bacteria from soil and infected leaf sample	1
14.	Staining and Identification of gram-positive and negative bacteria	1
15.	Market survey for available chemicals and bio-agents used in plant disease management	1
Total		15

Suggested readings:

1. R. Mehrotra (2003). Plant Pathology. Mcgraw Hill Education.
2. Agrios, G. N. (2006). Plant Pathology (6th edition). Elsevier Publishers, New Delhi.
3. Y.S. Paul (2018). Fundamentals of Plant Pathology. Brillion Publishing. Karol Bagh, New Delhi.
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9. Thapliyal, P.N. & Nene Y.L. (2018). Fungicides in Plant Disease Control - Fourth Edition. Medtech Publishers, New Delhi.
10. Tomos Webb (2019). Principle of Plant Pathology. Larsen & Keller Education.

Course Code: PLB121

Course Title: Fundamental of Genetics

Credit Hours: 2+1

Full Marks: 75

Theory: 50 Practical: 25

Objective

The overall objective of this course is to provide understanding on the science of genetics in terms of chromosomal behavior, principle of classical and modern genetics and solving numerical problems related to inheritance of qualitative, quantitative and cytoplasmic traits. The course will focus on offering students the opportunity to learn principle and application of genetics in agriculture.

Syllabus

The graduate level course is designed as a comprehensive exploration to the field of fundamental of genetics. The course focuses on the chromosome morphology, cell cycle and cell division, Mendel's laws, gene action and interaction, crossing over and linkage, sex determination, sex linkage, extra-nuclear inheritance, nucleic acids, gene expression, gene regulation and genetic variation.

Course breakdown

Theory

S. No.	Topic	No of Lectures
1	Introduction: Definition of genetics, terminology, branches of genetics, relation of genetics with other science, history and scope of genetics	1
2	Chromosome: Definition, chromosome number, chromosome size, chromosome morphology, terminology	1
3	Cell cycle and cell division: cell cycle, mitosis and meiosis cell division, Synaptonemal complex, Holiday junction, some enzymes involved, comparison and significance of cell division	3
4	Mendel's principle: Mendel's experiment and terminology, law of dominance, law of segregation and law of independent assortment, Punnett square and forked line method for genetic problems, chromosomal theory and relating Mendel's law with meiosis	3
5	Probability and Chi square test: probability and chi-square test in genetics	1
6	Gene action: Based on dominance effect, based on lethal effect, based on epistatic gene action (gene interaction), based on pleiotropism, multiple allele and pseudoallele	2
7	Crossing over and Linkage: Definition, types of crossing over, theory of crossing over, relation of crossing over and chiasma formation, factor affecting recombination frequency, types of linkage, detection of linkage, linkage maps and groups, chromosome mapping (Three point test cross)	3
8	Sex determination: Genetic sex determination, environmental sex determination and chromosomal sex determination in plants and animals, dosage compensation of X-linked gene	1
9	Interaction between genotype and environment: Introduction, external environmental effect and internal environmental effect	1
10	Pedigree analysis and sex linkage: Pedigree analysis, autosomal recessive and dominant traits, X-linked inheritance, Y-linked inheritance, sex linkage, sex limited traits, sex influenced traits	2
11	Extra-nuclear inheritance: cytoplasmic inheritance, types of cytoplasmic inheritance, Barnase/Barstar system, maternal effect	2
12	Nucleic acids: DNA and RNA, nucleotide components, Watson and Crick DNA model, chemical bonds in DNA, forms of DNA, types of RNA, complex structure of RNA, Nucleic acid chemistry, biological significance of DNA	2
13	Central Dogma of Genetics: Replication, transcription and translation, post-transcriptional modification	3

14	Gene regulation and transposon: <i>Lac</i> operon model, CAP-cAMP complex, transposable elements and McClintock experiment, Ac/Ds system in maize, IS elements in bacteria	2
15	Genetic variation: Mutation: Definition, characteristics of mutation, classification of mutation, mutagens (physical and chemical mutagens), types of gene mutation, practical application of mutation Chromosomal aberration: structural aberration (deletion, duplication, inversion, translocation, segregation of chromosome of a translocation heterozygote in meiosis, mechanism of chromosomal rearrangements); numerical aberration (origin and production of aneuploidy and euploidy, types of aneuploidy and euploidy, chromosomal pairing of triploid and tetraploid during meiosis, physical characteristics of polyploids)	3
	Total	30

Practical

S. No.	Topics	No. of Practical
1	Preparation of fixatives and stains	1
2	Preparing an onion root tip squash	1
3	Study on mitosis cell division from prepared slides	1
4	Study of meiosis in cereal anther following Aceto-Carmine smear technique	1
5	Karyotype study of any cereals	1
6	Numerical problems related to law of segregation	1
7	Numerical problems related to law of independent assortment	1
8	Numerical problems related to probability	1
9	Numerical problems related to chi-square test	1
10	Crossing over and recombinant production	1
11	Chromosomal mapping through three point test cross	1
12	Numerical problems related to pedigree analysis	1
13	Determination of pollen viability/sterility	1
14	Numerical problems related to maternal effect	1
15	Nuclear DNA isolation and gel electrophoresis	1
	Total	15

References

1. Acquaah, G. 2007. Principles of plant genetics and breeding. Blackwell Publishing
2. Fasella, P. and Hussain, A. 2014. Plant Biotechnology. Scientific International Pvt Ltd. India
3. Singh, R.J. 2003. Plant cytogenetics (2nd ed). CRC Press, USA
4. Griffiths, Anthony JF, Susan R Wessler, Richard C Lewontin, William M Gelbart, David T Suzuki, and Jeffery H Miller. 2005. An Introduction to Genetic Analysis (8th ed). WH Freeman, USA
5. Griffiths, Anthony JF, Susan R Wessler, Sean B Carroll, and John Doebley. 2015. Introduction to Genetic Analysis (11th ed). WH Freeman, USA
6. Tamarin, RH. 2008. Principle of Genetics (7th ed). McGraw Hill Company, USA
7. Pierce, Benjamin A. 2012. Genetics: A conceptual approach (4th ed). WH Freeman, USA
8. Brooker, Robert J. 2015. Genetics: Analysis and Principles (6th ed). McGraw Hill, USA
9. Gardner, EJ, Michael J Simmons and D Peter Snustad. 2006. Principle of genetics (8th edition). Willey India Private Limited, India
10. Strickberger, Monroe W. 1985. Genetics (3rd ed). Macmillan, USA

Course Code: SSC 122

Course Title: Soil Fertility Management

Credit Hours: 3(2+1)

Full Marks: 75

Theory: 50

Practical: 25

OBJECTIVES

Upon the completion of this course, the students will be able to understand soil fertility, role of essential nutrients in plants and their behavior in soils; inorganic and organic fertilizers, and role of organic matter and bio-fertilizers in crop production.

I. SYLLABUS

Concept, history and role soil fertility and plant nutrition; essential plant nutrients and criteria of essentiality; sources, functions, deficiency symptoms and availability of plant nutrients to plants; chemical fertilizers – composition, use, and behavior in soil; bio-fertilizers and their uses; preparation of manure, green manure, composted manure, biochar, jholmol; methods of soil fertility evaluation; integrated nutrient management; soil fertility problems of Nepal; best nutrient management practices for sustainable agricultural development.

II. COURSE OUTLINE

A. Lecture

S. N.	Topic	No. of Lectures
1.	Concept, history and importance of soil fertility and plant nutrition; criteria for essential nutrients, classification, forms and availability in soils and plants, factors affecting nutrient availability to plants	2
2.	Essential plant nutrients: a. Macro nutrients (N, P, K, Ca, Mg and S): Functions, deficiency symptoms, toxicity symptoms and their control measures; sources, forms in soils and plants and their availability, transformations in soil. c. Micronutrients (Fe, Mn, Mo, Cu, Zn, B, Cl, Ni): Functions, deficiency symptoms, toxicity symptoms and their control measures; sources, forms in soils and plants and their availability, transformations in soil. d. Beneficial elements: Functions, deficiency symptoms, control measures and availability to plants	3 2 1
3.	Fertilizer: Definition, classification and features of fertilizers; Concepts of chemical fertilizers, manure, biofertilizers and organic fertilizers	1
4.	Chemical Fertilizers: 1.1 Classification, composition and properties of Nitrogenous fertilizers and their behavior in soil 1.2 Classification, composition and properties of Phosphatic and potassic fertilizers and their behavior in soil 1.3 Classification, composition secondary nutrients (Calcium, Magnesium and Sulphur) containing fertilizers and their behavior in soil 1.4 Classification, composition and properties of Micronutrients (Zinc, Iron, Manganese, Copper, Boron, Molybdenum and Chlorine) containing fertilizers; behavior of applied zinc, iron, manganese and copper-containing fertilizer on soil 1.5 Compound and Complex fertilizers: Definition, types, classification, characteristics and advantages of complex fertilizers 1.6 Nano fertilizers: Types of Nano fertilizers, advantages of Nano fertilizers and its use in agriculture	2 1 1 1 1 1
5.	Organic manure and biofertilizers: a. Basic concepts of Manure; Source, classification, importance and preparation of organic manures and nutrient content on manures; b. Farm Yard Manure (FYM): Method of preparation of FYM, Transformation during decomposition of FYM, Factors influencing the composition of FYM, Important characteristics of FYM, <i>Jholmol-preparation, nutrient content and application</i> ; Cattle urine composition and uses c. Compost: Classification of compost, nutrient content of compost; Essential requirements for compost making; Management of compost pile; Methods of composting (Peat and Heap method; Super compost; Vermi compost; Compost tea or liquid manure);	1 1 1

	Biochar preparation and uses	1
	d. Biofertilizers: classification, preparation and application; benefits of biofertilizers	
	e. Green manuring: Concepts of Green manures and green leaf manures; Types of green manuring, characteristics of green manure crop, advantages and disadvantages of green manuring	1
6.	Soil fertility evaluation:	
	a. Visual diagnosis, plant analysis-tissue tests, sap test, total analysis, sensor based tissue analysis, and biological test method, microbiological methods	2
	b. Soil testing	1
	c. Methods of fertilizer recommendation to crops	1
7.	Soil fertility problems with respect to Nepalese agricultural system	1
8.	Best nutrient management practices: Best management practices (BMP) for Nitrogen, phosphorous and potassium; buffer strips, cover crops and conservation tillage	2
9.	Nutrient use efficiency and factors affecting nutrient use efficiencies	1
10.	Integrated nutrient management(INM), concept and relevance, components and management options of INM	2
	Total	30

B. Practicals

S. N.	Topic	No. of Practical
1	Identification and function of soil fertility laboratory equipment	1
2	Soil sampling and preparation for soil fertility analysis	1
3	Use of kit box for different elemental analysis in soil	1
4	Use of STFR for semi-quantitative analysis of soil	1
5	Chemical calculation and preparation of standard solution.	1
6	Determination of organic matter content in soil	1
7	Basic principles of micro- Kjeldahl distillation assembly, spectrophotometer, flame photometer and atomic absorption spectrometer	1
8	Plant sampling and their preparation for elemental analysis	1
9	Determination of total nitrogen in soil and plant	2
10	Determination of available phosphorus and potassium in soil	2
11	Determination of total phosphorus and potassium in plants	1
12	Manure and fertilizer analysis-quality test	1
13	Collection and identification of nutrient deficiency symptoms on major	1

Textbooks

1. Havlin, J. L., Tisdale, S. L., Nelson, W. L. and Beaton, J. D. 2021. Soil fertility and fertilizers: An introduction to nutrient management, Eight edition, Pearson Publication, 2021
2. Senthil, N. K., Rajasekar, M. and Paramasivan, M. 2023. Text book of soil fertility and Nutrient management, Orange books publications,
3. Reddy, S. R. 2017. Soil fertility and Plant Nutrition, Kalyani Publishers, India
4. Brady, N. C. and Weil, R. R. 2012. The Nature and Properties of Soils. 14th Ed. Prentice-Hall, Inc.

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1. White, R. E. 2009. Principles and Practice of Soil Science: The soil as a natural resource. 4th Ed. Blackwell Publishing Co.
2. Roy, R. N. 2006. Plant Nutrition for Food Security: a guide for integrated nutrient management. Food and Agriculture Organization of the United Nations.
3. Troeh, F. R. and Thompson, L. M. 2008. Soils and soil fertility, Sixth edition, Blackwell Publishing,
4. Sparks, D. L., Page, A. L., Helmke, P.A. and Loeppert, R. H. 2020. Methods of Soil Analysis (part 3): chemical methods first edition, ACSESS publication
5. Ok, Y.S., Uchimiya, S. M., Chang, S.X., and Bolan, N. 2020. Biochar, Production, characterization and application, CRC press
6. Giri, B., Prasad, R., and Wu, Q. 2019. Biofertilizers for Sustainable Agriculture and Environment (Soil Biology, 55) 1st ed. Springer
7. Prasad, R. and Shivay, Y. S. 2021. Soil fertility and Nutrient Management, New India Publishing House
8. Horst, M. 2011. Marschner's Mineral Nutrition of Higher Plants, 3rd edition, Academic press.
9. Jadeja, A.S., Hirpara, D.V., Vekaria, L.C., and Sakarvadia, H.L. 2021. Soil Fertility and Nutrient Management: A Way to Sustainable Agriculture, Jayay Publishing house
10. Kolay. A. K. 2011. Soil fertility Atlantic Publication

Course Code: EXT 122

Course Title: Fundamental of Agricultural Extension

Credit Hours: 3(2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES

Upon completion of this course, students will understand the basic concepts of education and extension education, including their principles, philosophies, objectives, methods, systems, and practices. They will also learn to apply agricultural extension knowledge to the farming community.

SYLLABUS

Education and Extension Education, Extension Teaching-Learning Process, Extension Teaching Methods, Extension Approaches in Nepal, New Trends in Agricultural Extension, Rural Development Programs in Nepal, Transfer of Technology, Proposed Curriculum of fundamentals of agricultural extension, Types of technology, Leader and Leadership, Program Planning in Agricultural Extension, Land Grant College (LGC) System

COURSE BREAKDOWN

A. Theory Lectures

S. No.	Topic	No. of Lectures
1	Education: Understanding the meaning, definition, and types of education including formal, informal, and non-formal education.	2
2	Extension Education: Exploring the meaning, definition, necessity, scope, process, history, objectives, philosophy, principles, and approaches of extension education.	3
3	Extension Teaching-Learning Process: Analyzing the concept, meaning, definition, elements, principles, theories, and laws associated with the teaching-learning process in extension education.	2
4	Extension Teaching Methods: Understanding the concept, meaning, definition, types, and applications of various teaching methods in agriculture development; including classification of extension teaching methods, use of audio-visual aids, and media mix strategies.	3
5	Extension Approaches in Nepal: Reviewing past and present extension approaches utilized in Nepal.	2

6	New Trends in Agricultural Extension: Exploring the meaning, objectives, and features of new trends in agricultural extension, including privatization, pluralistic concepts, ICT in extension education (cyber extension/e-extension), market-led extension, and farmer-led extension.	2
7	Rural Development Programs: Examining various rural development programs and term plans launched by the Government of Nepal.	2
8	Diffusion and Adoption of Innovation: Understanding the concept, meaning, definition, attributes of innovation, innovation decision process, and adopter categories and their features	3
9	Transfer of Technology: Exploring the concept, meaning, definition, and relationship of technology transfer to agricultural extension, along with types of technology.	2
10	Sustainable and Appropriate Technology: Understanding the concept, meaning, definition, features, and relationship of sustainable and appropriate technology to high technology, including the concept of Sustainable Development Goals (SDGs) and sustainable agricultural technology, as well as Indigenous Knowledge/Technological Knowledge/Traditional Knowledge.	2
11	Leadership: Understanding the concept, meaning, definition, types, and theories of leadership.	2
12	Capacity Building: Exploring the concept, meaning, and process of capacity building for extension personnel and farmers.	1
13	Program Planning in Agricultural Extension: Understanding the concept, meaning, and definition of program planning, including principles and steps of program planning, use of RRA/PRA tools, types and levels of planning in agricultural programs in Nepal, and monitoring and evaluation (M&E) of agricultural development programs.	3
14	Land Grant College (LGC) System: Exploring the concept, meaning, definition, role, and functions of the LGC system, as well as the role of agricultural colleges and universities in agricultural development.	1
Total		30

Practical:

1. **Farm Level Production Plan:** Preparation of crop production and livestock production plans (simulated). 2
2. **Interaction Visits and Meetings:** Studying the program planning process, organizational setup, functions, and responsibilities through interaction visits and meetings.
Government Extension Units/Institutions: Visits to understand their functions and responsibilities. 2
Research Institutions/NARC: Visits to research institutions to study their planning processes and service delivery. 2
3. **Key Informants Interviews:** Conducting interviews with I/NGO/CBOs/Co-operatives/Private sectors to study their planning processes, work plans, and service delivery methods. 2
4. **Organizational Structure:** Studying the organizational structure of various levels of agricultural offices. 1
5. **Participatory Rural Appraisal (PRA):** Studying different PRA tools to analyze a community. 3
6. **Problem Sensing and Ranking Techniques:** Learning and applying techniques for problem sensing and ranking in agricultural communities. 1
7. **Village Level Agricultural Extension Research:** Conducting research at the village level, including proposal writing, questionnaire preparation, and data collection. 2

TOTAL

15

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