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FACULTY OF AGRICULTURE



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Course Bulletin of B. Sc. Ag

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AGRICULTURE AND FORESTRY UNIVERSITY (AFU)
Rampur, Chitwan, Nepal
2072

AFU BULLETIN

Faculty of Agriculture

Course Bulletin of B.Sc. Ag.

**Agriculture and Forestry University
Rampur, Chitwan.**

2072

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Foreword

It gives me an immense pleasure to write this foreword for this course bulletin of B.Sc. Ag Program. This bulletin was long due and yet timely. The Agriculture and Forestry University (AFU) is the first State-owned and technical University of Nepal established in accordance with the Agriculture and Forestry University Bill enacted by the Parliament in 2010. The constituent campuses of Tribhuvan University, the Agriculture Campus in Rampur, the Dean office, Institute of Agriculture and Animal Science, Chitwan (IAAS) and the Institute of forestry, Hetauda Campus were merged, and Agriculture and Forestry University was created in Rampur, Chitwan. The university aims at producing needed human resources to promote education, research and development in agriculture, livestock, veterinary science, fisheries, forestry and allied disciplines.

A bulletin of such kind which includes all the information on the academic requirements needed by the University to complete the program is so important to the students, faculty members & also to all those who intend to get admission in this program in the University. During the beginning phase, AFU had no faculty members of its own & upon the university administration's request, faculties of Tribhuvan University & experts from other institutions worked days and nights to complete the details of course requirements. Course coordinators were assigned to review categories of courses for further refinements. These courses were then widely reviewed, and modified by Subject Committees and forwarded to the related Faculty Board. The courses were then finally approved by the University Academic Council. I would like to acknowledge for the efforts of Professor Shrawan Kumar Sah, the Director of Curriculum Development Center for the painstaking job of bringing this bulletin to the present shape.

Last but not the least, the guidance of Dr. Surya Kant Ghimire, Registrar was crucial and his liberal attitude in helping this bulletin get published with all logistics and administrative support was helpful and encouraging.

I am sure this bulletin will help all those who are interested in pursuing higher studies in this University. I am confident that any errors identified and suggestions received during the course of its use will be duly considered by the Curriculum Development Center in its second edition.

Professor Kailash N. Pyakuryal, Ph.D.
Vice-Chancellor



Agriculture and Forestry University

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Message From Registrar

April, 29, 2015

Agriculture and Forestry University (AFU) is a state owned premier University for higher education, research and extension in the field of agriculture, veterinary, animal science, fisheries and forestry. Since its inception in 2010, AFU has been making continuous and strenuous efforts to design and implement educational programs for the established and emerging needs of the agriculture and forestry sector in the country. This bulletin is the outcome of such efforts for last five years.

This bulletin contains the academic information, rules and regulations, admission requirements and course description of B.Sc. A.g. The various aspects of curriculum and course contents have been thoroughly discussed among the faculty members, consumer agencies and various stakeholders. The curriculum development is a dynamic process and it demands periodic review and update. Therefore, I appreciate receiving suggestions, comments or criticism from faculty members, students, consumer agencies and various stakeholders involved in agriculture and forestry.

I would like to thanks all the participants involved in the preparation of this bulletin. The chairpersons and the members of the subject committees and the faculty members of AFU deserve thanks and appreciations. Finally, I appreciate and congratulate Prof. Dr. Shrawan Kumar Sah, Director, Curriculum Development Center for his efforts in bringing out this bulletin in the present shape.

I hope, this bulletin will be useful and serve as guideline for the faculty members, students and all other concerned personnel and institution involved in the agriculture and forestry sector development in Nepal.

Thanks

Surya Kant Ghimire, PhD.
Registrar
&
Chairman of CDC

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1. INTRODUCTION

1.1 Agriculture and Forestry University

Agriculture and Forestry University (AFU) is Nepal's premier University for higher education, research and extension in the field of agriculture, veterinary, animal science, fisheries, biotechnology and forestry. The University was established with the enactment of Agriculture and Forestry University Act- 2010 by Nepalese Parliament. This is only the specialized University of the country in agriculture and forestry. It was established in the investment of Government of Nepal for the development of agriculture and forestry. The purpose of the University is to conduct study, teaching and research within the country to produce high standard academic and skilled human resource in the concerned subject in an integrated manner for the improvement of social and economic status of the rural people by modernization of agriculture and forestry. The University was constituted by combining the Institute of Agriculture and Animal Science (IAAS), Rampur, Chitwan and Institute of Forestry, Hetauda, Makwanpur which were previously under Tribhuvan University (TU)

Objectives of AFU

1. To design and implement educational programs in agriculture, veterinary, animal science, fisheries and forestry for the established and emerging needs of the agriculture and forestry sectors in the country;
2. To produce technically competent man power in the field of agriculture, veterinary, animal science, fisheries and forestry for the application of knowledge and skills to the development of the Nation;
3. To promote excellence in teaching, research and extension in agriculture and forestry;
4. To encourage and support faculty members and students for research and scholarly activities relevant to the needs of agriculture and forestry; and
5. To foster students self development, commitment and responsibility for the welfare of Nepalese society.

1.2 Faculty of Agriculture, Rampur, Chitwan

Faculty of Agriculture (FOA) is located at Rampur in Chitwan district. It was previously IAAS under TU established in 1974. It is 9 Km West of the town of Bharatpur; Headquarters of Chitwan district and 157 Km South West from Kathmandu. It is situated at an altitude of 228 meters above mean sea level. It has subtropical humid climate with three distinct seasons: rainy season (June-October), cool winter (November–February) and summer season (March-May). The hottest month is May and the coolest month is January. The average annual rainfall is about 2000 mm. The FOA lies in the south side of Bharatpur–Meghauli road. It has 110 ha of land which includes administrative and Post Graduate building, class rooms, library, auditoriums, laboratory buildings, boys and girls hostels, dispensary, staff and faculty quarters, sport ground, agronomy and horticulture farms.

1.3 Faculty of Veterinary, Animal Science and Fisheries

Faculty of Veterinary, Animal Science and Fisheries (FOVAF) is also located at Rampur in Chitwan district. The FOAF lies in the North side of Bharatpur–Meghauli road. It has 125 ha of land which includes class room building, veterinary teaching hospital, laboratory buildings, staff and faculty quarters, and livestock and aquaculture farms.

1.4 Faculty of Forestry, Hetauda, Makwanpur

Faculty of Forestry (FOF) is located in Hetauda Municipality in Makwanpur district. It lies in 132 Km South from Kathmandu and 76 Km South East from Narayangarh. The FOF is situated at an altitude of 450m asl. It has subtropical humid climate with three distinct seasons: rainy season (June–October), winter season (November–February) and summer season (March–May). The hottest month is May and the coolest month is January. The average annual rainfall is about 1972 mm. The campus has 105 ha of land which includes administrative building, museum complex, class room buildings, auditorium halls, staff and faculty quarters, student hostels and forest area. The significance of this campus lies on the fact that different type of forests such as Terai, Siwalik and Mahabharat ranges are at easily approachable distance for conducting excursions as well as short and long term researches.

2. ACADEMIC PROGRAMS OF FACULTY OF AGRICULTURE

The FOA offers following degree from different faculties and campuses:

2.1 Bachelor of Science in Agriculture (B. Sc. Ag.)

The aim of this program is to train academically competent and practical oriented professional agriculturist. B. Sc. Ag. Program is eight- semester (four- year) after I. Sc. or I. Sc. (Agriculture) or 10 + 2 (Science).

2.2 Master of Science in Agriculture (M. Sc. Ag.)

The aim of the program is to train highly competent man power in the various specialized field of agriculture. This is two-year program after B. Sc. Ag and maximum allowable duration is four years. The M. Sc. Ag. is conducted in nine Departments of Faculty of Agriculture (FOA) in Rampur, Chitwan.

2.3 Doctor of Philosophy (Ph. D.)

Doctor of Philosophy (Ph.D.) program is conducted in various Departments of FOA in Rampur, Chitwan. Ph. D. is three years program after master degree in the relevant field and maximum allowable duration is seven years. The Ph. D. program is conducted either by course and research or by research only.

3. ADMISSION OF THE UNDERGRADUATE STUDENTS

3.1 Admission committee

The Faculty Dean forms an admission committee within the framework of the Agriculture and Forestry University's rules and regulations to formulate the policies concerning student intake and entrance examination.

3.2 Advertisement for Admission

An advertisement regarding student admission is done in national newspaper and on the website of Agriculture and Forestry University ([http:// www. Afu.edu.np](http://www.Afu.edu.np)). The exact date of admission process may vary from year to year but it generally starts in August- September and classes starts from mid of November.

3.3 Admission requirements for Bachelor degree

Students with I. Sc. (Basic Science) or 10+2 (Science) with compulsory English, Physics, Mathematics, Chemistry and Biology securing a minimum of 50% marks in aggregate from any recognized Universities or Boards are eligible to apply for B.Sc. Ag, B.V.Sc. & A.H., B.Sc. Fisheries, B.Sc. Forestry program. The selection for admission is on merit basis through an entrance examination. Girls' students and students from disadvantage group are provided some preferences in terms of reserved quota and leverages in admission requirements.

4. EDUCATION SYSTEM

4.1. Semester system

The Agriculture and Forestry University follows a semester system of education for all academic programs. There are two semesters in each academic year. One semester covers a period of ninety effective working days of teaching and two weeks for final examination. The academic calendar is prepared in the beginning of academic session by the faculty dean and circulated to all departments for effective functioning of academic program.

4.2 Vacations and holidays

There will be one month vacation at the start of Dashain festival and one month vacation during summer generally after the middle of Jestha. The other vacations depend upon the calendar of the Agriculture and Forestry University. The class work generally remains closed during vacation.

5. EXAMINATION SYSTEM

5.1 Internal assessment

The Agriculture and Forestry University follows semester system of examination for evaluation. A total of 20% of full marks in theory in each subject is evaluated internally by the subject teacher through an internal assessment. The student must secure 40% marks in the internal assessment to qualify for final examination. The course teacher gives one chance for makeup test to those who fail in the first internal assessment or missed for valid reasons.

5.2 Final theory and practical examination

The Examination Controller Office, AFU conducts a separate final theory examination of 80% of total marks, and 100% of practical for each level externally through an external system of examination. A students must secure at least 40% marks in theory and practical separately to pass the final theory and practical examination in each subject. The students who fail in the final theory or practical examination are allowed to take once back-paper examination conducted by the Examination Controller Office, AFU in each semester after about a month of announcement of final examination result of previous semester. Those who fail in the back paper examination must register the course again and take the regular class along with regular students of the particular semester.

5.3 Attendance Requirement

A student must attend at least 70% of classes in theory and practical in each subject to be eligible for final examination. All teachers will submit their attendance register to the Faculty Dean after the end of classes of each subject.

5.4 Grading System

A student will be graded at 1-4 scale; 1 being the lowest and 4 being the highest grade. A, B, C and D grade will be awarded according to marks obtained in the courses.

Grade	Marks obtained
A	80 % and above
B	65 % and less than 80 %
C	50 % and less than 65 %
D	40 % and less than 50 %

The students must secure average grade point 2 to pass the undergraduate courses.

6. CURRICULUM DESIGN AND DELIVERY

The curriculum is designed to provide learning opportunities to meet the requirements for the degree. The curriculum includes the basic and core courses and practical required for each disciplines. The content of courses has been discussed critically among the experts and faculty of related disciplines. The course codes listed have short text of the subject matter with numbers. The first digit of the number indicates the year in which a course is offered and other digit indicates the serial number of course. Each theory or practical credit hours is equivalent to 25 marks in theory or practical. For example, a course with credit hours of 2+1 has full marks of 75 (Theory 50 and practical 25). One credit for theory means one- hour of theory per week, and for practical means two to three hours of practical per week.

7. STUDENTS' WELFARE

The facilities for student' welfare at faculty of Agriculture includes students' hostels, health care and medical facilities and facilities for sports, extracurricular activities and recreation. There is Directorate of Student Welfare (DSW) for organizing sports and other cultural programs. In addition students clubs and cultural groups also organize extracurricular activities from time to time.

Scholarship

The AFU provides scholarship to meritorious students. At present 25% of the students receive a scholarship of Rs.600/- per month up to maximum of 5 months in each semester. The scholarship of first semester is given on the merit basis on the marks obtained in the internal assessment whereas; in the second semester and onwards scholarship is given on the basis of marks obtained in previous semester. In addition 25 percent of students are provided with free ship that waives payment of the tuition fees.

8. OTHER REQUIREMENTS AND RULES

The aspects of instruction, evaluation and other areas of academics not mentioned here are as the rules and regulations of AFU. The university may change any rules and regulations any time as required for effective functioning.

**SEMESTERWISE DISTRIBUTION OF COURSES
FOR B. Sc. Ag. PROGRAM**

Ist Semester

SN	Course Code	Course Title	Cr. Hr.
1	PLB 101	Introductory Genetics	2+1
2	HRT 101	Introductory Horticulture	2+1
3	AGR 101	Principles of Agronomy	2+1
4	AEC 101	Principles of Economics	2+0
5	BCH 101	General Biochemistry	2+1
6	SSC 101	Fundamentals of Soil Science and Geology	2+1
7	LPM 101	Introductory Animal Science	2+1
Total			14+6

2nd Semester

SN	Course Code	Course Title	Cr. Hr.
1	PPH 101	Introductory Crop Physiology	2+1
2	HRT 102	Ornamental Horticulture	2+1
3	AGR 102	Cereal Crops	2+1
4	AEC 102	Farm Management and Production Economics	2+1
5	SSC 102	Soil Fertility, Fertilizers and Integrated Nutrient Management	2+1
6	EXT 101	Rural Sociology	2+1
7	LPM 102	Ruminant Production	1+1
Total			13+7

3rd Semester

SN	Course Code	Course Title	Cr. Hr.
1	MIB 201	Agricultural Microbiology	2+0
2	ENT 201	Introductory Entomology	2+1
3	AMT 201	Introductory Agro meteorology	2+0
4	PLP 201	Introductory Plant Pathology	2+1
5	AGR 203	Grain Legumes and Oilseed Crops	1+1
6	HRT 203	Fruit and Plantation Crop Production	2+1
7	EXT 202	Fundamentals of Agricultural Extension	2+1
8	AQU 201	Principles of Aquaculture	1+1
9	LPM 203	Pig and Poultry Production	1+1
Total			15+7

4th Semester

SN	Course Code	Course Title	Cr. Hr.
1	ECO 201	Environmental Science and Agro ecology	2+0
2	PLB 202	Introductory Plant Breeding	2+1
3	AGR 204	Commercial Crops	2+1
4	AST 201	Agricultural Statistics	2+1
5	HRT 204	Vegetable and Spice Crop Production	2+1
6	ENT 202	Principles and Practices of Insect Pest Management	2+1
7	SSC 203	Soil Physics, Genesis and Classification	1+1
8	ANU 201	Animal Nutrition and Feeding Practices	2+1
Total			15+7

5th Semester

SN	Course Code	Course Title	Cr. Hr.
1	ECO 302	Medicinal and Aromatic Plants	1+1
2	ENT 303	Economic Entomology	2+1
3	PLP 302	Crop Diseases and their Management	2+1
4	EXT 303	Agricultural Communication	2+1
5	AEC 303	Agriculture Marketing and Cooperatives	2+0
6	AGR 305	Principles and Practices of Seed Technology	1+1
7	SSC 304	Introductory Soil Conservation and Watershed Management	2+0
8	PLB 303	Molecular and Population Genetics	2+0
9	ANB 301	Principles and Practices of Animal Breeding	2+1
Total			16+6

6th Semester

SN	Course Code	Course Title	Cr. Hr.
1	EXT 304	Social Mobilization and Community Development	2+1
2	PLP 303	Mushroom Cultivation	0+1
3	ENT 304	Industrial Entomology	1+1
4	HRT 305	Post harvest Horticulture	2+1
5	AGR 306	Weed Science	1+1
6	AEN 301	Farm Power and Machinery	1+1
7	PLB 304	Introductory Resistance Breeding	2+0
8	ANU 302	Fodder Production and Pasture Management	2+1
9	LPM 304	Introductory Dairy Science	2+1
Total			13+8

7th Semester

SN	Course Code	Course Title	Cr. Hr.
1	ECO 403	Agrobiodiversity Conservation and Climate Change	2+0
2	AEC 404	Agriculture Project Planning	2+1
3	HRT 406	Agroforestry	1+1
4	BIT 401	Introductory Biotechnology and Biodiversity	2+0
5	AEN 402	Principles and Practices of Farm Water Management	2+1
6	AEN 403	Farm Structures and Surveying	2+1
7	ANU 403	Applied Human Nutrition	2+0
8	LEE 401	Learning for Entrepreneurial Experience	0+5
Total			13+9

8th Semester

SN	Course Code	Course Title	Cr. Hr.
1	AEC 405	Agribusiness Management	2+1
2	VMC 401	Animal Health	2+1
3	LEE 402	Learning for Entrepreneurial Experience	0+10
Total			4+12

AGRICULTURAL ECONOMICS AND AGRIBUSINESS MANAGEMENT

Course Code : AEC 101

Course Title : Principle of Economics

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

OBJECTIVES

Upon the completion of this course, the students will be able to have better understanding of economic theories related to production, consumption, distribution and welfare.

I. SYLLABUS

Concept and definition of Economics; Subject matter, nature, and relationship with other disciplines. Concepts of economic terms: Goods, Service, utility, value, price, wealth and welfare. Theories of consumption and indifference curves, law of demand and supply, elasticity of demand and supply, cost functions and relationship. Market structure and price analysis. Characteristics and theories of land, labor and capital. Concept of welfare economics and Pareto optimality. Concept and measurement of national income.

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lectures
1.	Concept and definition of economics – Adam smith, Marshall, and Robins	3
2.	Subject matter, nature, relationship and importance of economics	2
3.	Terminologies–goods, service, utility, value, wealth, price, equilibrium, want, welfare	1
4.	Theories of consumer behavior and indifference curves and their analysis –concept, types, and properties	4
5.	Law of demand and elasticity of demand: Price elasticity, income elasticity and cross elasticity	2
6.	Law of supply and elasticity of supply	1
7.	Cost functions and their relationships	2
8.	Market and Market structures – concept and characteristics	2
9.	Price determination under perfect, monopoly and monopolistic markets	3
10.	Land – characteristics and theories of rent	2
11.	Labor – characteristics and theories of wages and population	2
12.	Capital – characteristics and theories of interest	2
13.	Organization – Concept and theory of profit	1
14.	Welfare economics: Concept and pareto optimality	1
15.	National income: Concept and measurement	2
Total		30

REFERENCES

Chopra, P. N. 2000. Principles of Economics. Kalyani Publishers, New Delhi.

Hirshleifer, J. 1987. Price Theory and Its Application. Printice Hall of India, New Delhi.

McConnell, C.R. 1975. Economics: Principles, problems, and policies, McGraw-Hill, USA.

Course Code : AEC 102

Course Title : Farm Management and Production Economics

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 principles of farm management and production economics dealing with the analysis of farm resources having alternative uses.

I. SYLLABUS

Definition, nature, scope and importance of farm management in relation to other sciences. Farm resource management- land, labour, machinery and civil works. Farm management problems in Nepal. Production relationship- factor-product, factor-factor and product-product relationships. Principles of farm management decisions- principle of variable proportion, cost principle, factors substitution, equi-marginal return, opportunity cost, principles of comparative advantages, the principle of time comparison. Farm planning and budgeting. Farm record and account. Farm efficiency measures. Risk and uncertainty. Linear programming: concept and approach.

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lectures
1.	Concept, nature, subject matter and scope of farm management	2
2.	Importance of farm management and problems related to management of farms in Nepal.	1
3.	Management of farm resources- land, labour, machinery and equipments and civil works	4
4.	Production relationships – Factor-product relationships	2
5.	Factor-factor relationship and least cost combination	2
6.	Product-product relationship and principle of comparative advantage	2
7.	Principles of farm management decisions- variable proportion, factor substitution, cost principle, equi-marginal return, opportunity cost principle, time comparison and comparative advantage principle	5
8.	Farm planning-characteristics and techniques	2
9.	Farm budgeting- enterprise partial budgeting and complete budget	1
10.	Farm inventory, depreciation and valuation technique of farm assets	2
11.	Farm records keeping- balance sheet, income statement and cash flow statement	2 1
12.	Farm efficiency measures	1
13.	Risk and uncertainty- concept, types, safeguards and measures	2
14.	Linear programming- concept and approach	2
Total		30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Determination of optimum input use and maximization of profit using one input	1
2.	Least cost combination of inputs	1
3.	Revenue maximization through optimum enterprise combination	1
4.	Farm record keeping	1
5.	Preparation of farm inventory	1
6.	Development of new farm plan	1
7.	Preparation of Balance Sheet of a farm	1
8.	Preparation of Income Statement of farm	1
9.	Development of Cash Flow budget of a farm	1
10.	Farm physical efficiency measures	1
11.	Farm financial efficiency measures	1
12.	Computation of depreciation of farm assets	1
13.	Valuation techniques of farm assets	1
14.	Exercise on time value of money	1
15.	Exercise on linear programming	1
Total		15

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Manson, J. 1996. Farm Management. Kangaroo Press, Pennsylvania State University.

Kay, R.D. and Edwards, W. M. 1994. Farm Management. McGraw Hill, Inc., New Delhi.

Kahlon, A. S. and Singh, K. 1992. Economics of Farm Management in India. Allied Publishers, New Delhi.

Shankhyan, P. L. 1983. Introduction to Farm Management, Tata, McGraw-Hill, Co. Ltd., New Delhi.

Johl, S. S. and Kapoor, T. R. 1973. Fundamentals of Farm Business Management . Kalyani Publishers, New Delhi.

Course Code : AEC 303

Course Title : Agriculture Marketing and Cooperatives

Credit Hours : 2 (2+0)

Full Marks: 50

Theory: 50

Practical: 0

OBJECTIVES

Upon the completion of this course, the students will be able to understand the meaning, concept and importance of agricultural marketing and cooperatives. They will also be able to develop analytical techniques in agricultural marketing research.

A. SYLLABUS

Concept and definition–Market and marketing, importance of agricultural product prices and marketing of both inputs and outputs. Meaning and concept of utility, consumers behavior, consumer and market equilibrium, revealed preference, consumer surplus, demand for agricultural products and their derivation. Supply of agricultural products and their derivation. Price, income and cross elasticity of demand and supply, relationship among elasticity and their use. Life cycle and development of products, marketing strategy, market and product promotions. Market structures, price determination and equilibrium in pure competition, monopoly, and oligopoly; Price discrimination. Marketing functions, marketing channels and costs. Marketing margins and price spreads. Spatial and temporal price variation. Marketing research, Marketing efficiency and its measurement, economic models for price analysis. Government intervention and public institutions in marketing, Cooperatives- concept, history, definitions, role, organization, structure, cooperative law and by laws, developing agriculture cooperatives, cooperative marketing, cooperative farming, strength and opportunities.

II. COURSE BREAKDOWN

A. Lecture

S.N.	Topic	No. of Lectures
1	Agricultural marketing: concepts of market and marketing; nature of agricultural commodities; classification of markets; importance of product prices and agricultural marketing for socioeconomic progress.	2
2.	Theory of consumer behavior: concept of utility and its measuring approaches; demand function and factors affecting consumers' behavior, and market equilibrium; consumers' and producers' surplus	2
3.	Elasticity: various elasticity of demand, supply and their relationship	2
4.	Theory of firm: theory and characteristics of firms; supply function and its derivation; life cycle and development of products; marketing strategy, market and product promotions	3

5	Market structure and equilibrium: marketable surplus; market structure, price determination and price discrimination	4
6.	Marketing functions and channels: marketing functions: physical, exchange and facilitating functions; marketing channels, marketing cost; marketing margins and price spreads	3
7.	Price variation: price movement over time: seasonal and cyclic price variation; spatial price variation; spatial distribution of commodities and regional equilibrium models	3
8.	Marketing research: research in agricultural marketing; marketing efficiency and its measurement;	3
9.	Government intervention and public institutions: role of government in product pricing and agricultural marketing; public institutions related to production, marketing and their promotion	2
10.	Cooperatives- concept, definitions, history, role, organization, structure, cooperative law and bylaws, cooperative farming, cooperative marketing.	5
<hr/> Total		30
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Rhodes, V. J. 1983. The agricultural marketing systems. John, Wiley, and Sons, Inc. Singapore.

Koutsoyiannis, A. K. 1994. Microeconomics, Printice Hall, India

Barker, J. 1989. Agricultural Marketing. 2nd ed. Oxford University Press. UK Tomek, W. 1984. Agriculture product prices,

Course Code : AEC 404

Course Title : Agriculture Project Planning

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 prepare research proposal related to agriculture, and apply the tools of planning, implementation, monitoring and evaluation.

I. SYLLABUS

Basic concept- plan, program and project; Project cycle – steps, need assessment/problem identification and different aspects (PESTEL Analysis); Proposal: concept, types, method; Scientific proposal writing- logical framework and PCN, proposal development; Project appraisal; Monitoring and evaluation of agricultural projects-concepts, methods and technique; ZOPP approach in project planning; Socioeconomic research methods; Technical writing – report contents, presentation and visual display of data, acronyms and footnotes, abstract, summary and conclusions, references, appendices and proof reading.

II. COURSE BREAKDOWN

A. Lectures

S.N.	Topic	No. of Lectures
1.	Basic concept- plan, program and project	1
2.	Project Cycle- steps, need assessment/problem identification	2
3.	Different aspects of project preparation (PESTEL Analysis)	2
4.	Proposal-concept, types and methods	2
5.	Scientific proposal writing- LFA, PCN and full proposal	5
6.	Project appraisal- concept and techniques	2
7.	Monitoring and evaluation- concept, types and techniques	2
8.	Participatory approach of M & E- concept, approach and method	2
8.	ZOPP approach in project planning	2
9.	Socioeconomic research methods	3
10.	Report contents	1
11.	Presentation and visual display of data	1
12.	Acronyms and footnotes	1
13.	Abstract, summary and conclusions	2
13.	References, appendices and proof reading	2
Total		30

B. Practical

S.N.	Topic	No. of Practicals
1.	Need assessment/Case study	2
2.	Pre-feasibility and feasibility study of a project	2
3.	Financial and economic analysis of a research and development projects conducting a sample survey, data analysis and interpretation	2
4.	Preparation of project concept notes and research project proposal	4
5.	Technical writing	5
Total		15

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NEDA. 1984. Project Development Manual, National Economic and Development Authority, Republic of the Philippines.

Gitiinger, J. P. 1982. Economic analysis of agricultural projects. Published for the Economic Development Institute of the World Bank. The John Hopkins University Press Baltimore and London.

Reutlinger, S. 1970. Techniques for Project Appraisal under Uncertainty. Baltimore, Md.: Johns Hopkins University Press.

Course Code : AEC 405
Course Title : Agribusiness Management
Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES

Upon the completion of this course, the students will gain theoretical as well as practical knowledge on different aspects of agribusiness management.

I. SYLLABUS

Concept and definition of agribusiness management. Basic concepts and definitions of firm, plant, industry and their interrelationships with respect to agricultural production; Constraints and opportunities of agribusiness in Nepal; Agribusiness environment, management systems, Organization and business management functions and managerial decision. Human behavior in organization; Financial management of agribusiness – preparation of financial statements and analysis, agribusiness financing; appraisals techniques of agribusiness investment activities: methods of investment analysis; Leadership and motivation, economic principles involved in capital acquisition, agribusiness control program and evaluation; Value chain analysis: concept, mapping and approaches; Production planning and risk management; in agribusiness implications of international trade in agriculture sector of Nepal; Agricultural policies of Nepal and their impact on agribusiness enterprises.

II. COURSE BREAKDOWN

A. Lectures

S.N.	Topic	No. of Lectures
1.	Concept and definition and scope of agribusiness management in Nepal	2
2.	Basic concept and definitions of firms, plant, industry and their interrelationships with respect to agricultural production	1
3.	Agribusiness environment and management systems,	2
4.	Organization and business management functions and managerial decision	2
5.	Human resource management in organization	2
6.	Preparation of financial statements, analysis and agribusiness financing	2
7.	Investment appraisals through use of discounted and appraisal measures	3
8.	Leadership and motivation, economic principles involved in capital acquisition	3
9.	Agribusiness control program and evaluation	2
10.	Value chain analysis: concept, mapping and approaches	3
11.	Production planning in agribusiness – planning production, risk management	2
12.	Implications of international trade in agriculture sector of Nepal	3
13.	Agricultural policies and their impact on agribusiness enterprises in Nepal	3
Total		30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Review of organization and management structure in different agro-industries	1
2.	Assessment of Demand-supply of agri. commodities in different agro-industries	1
3.	Analysis of backward and forward linkages of major agricultural products	1
4.	Preparation and analysis of balance sheet – A case study	1
5.	Preparation and analysis of profit and loss statement – A case study	1
6.	Cash flow analysis of agro industries	1
7.	Ratio analysis and forecasting techniques	1
8.	Investment appraisals through discounted cash flow measures of project worth	1
9.	Visit to an agribusiness unit for the analysis of problems, performances and prospects – A case study	1
10.	Value chain mapping of major agricultural subsectors	2
11.	SWOT analysis of major agricultural subsectors	1
12.	Preparation of business plan for agricultural firms	3
Total		15

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AGRICULTURAL EXTENSION AND RURAL SOCIOLOGY

Course Code : EXT 101

Course Title : Rural Sociology

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

OBJECTIVES

Upon the completion of this course the students will understand the sociological concepts, theories and their contribution and application in agriculture development and the field of agriculture extension education system.

I. SYLLABUS

Sociology and rural sociology- differences and similarities in meanings and concepts, contribution to agriculture extension, social institutions, social processes, norms, values, socialization and deviance, social cultures, customs and traditions social structure and social systems, some important sociological theories, social changes process, impact and factors of change, social groups, formation and behavioural change, social festivals, rituals and social heritage and their relationship to social change and development.

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lectures
1.	Sociology: Meaning, scope, importance and relationship with other social sciences	1
2.	Rural Sociology: Meaning, nature, and scope	1
3.	Development of Rural Sociology as a major field of sociology	1
4.	Differences between rural and urban society, Rural Urban Continuum	1
5.	Social movement: meaning and causes of social movement	1
6.	Types and theories of social movement	1
7.	Social change: meaning, factors of social change	1
8.	Theories of Social Change	1
9.	Social process (process of social interaction): Accommodation, Adjustment, Amalgamation, Assimilation	1
10.	Social Process: Cooperation, Consensus, Competition, Conflict, Integration	1
11.	Social stratification: meaning and bases (class, caste, ethnicity, power, gender)	1
12.	Social mobility and dynamics of emerging identity	1
13.	Rural dynamics: migration	1
14.	Culture and customs in rural Nepal: caste-based norms (folkways, mores)	1
15.	Culture and customs in rural Nepal: value and belief systems in relation to rural development	1

16.	Common social ceremonies, rituals and festivals: types and importance	1
17.	Rural-social institutions: Concept and importance	3
a.	Social institutions: household, family and its type, marriage system	
b.	Economic institutions: farming, fishing, hunting, exchange labor, child labor and labor exploitation Educational institutions: types and functionc.	
c.	Religious institutions: types of religion, their maintenance and followers	
d.	Political institutions: state and its elements, function	
e.	Recreational institutions	
f.	Interrelationship of rural social institutions and its importance	
18.	Traditional caste system and their occupation in Nepal	1
19.	Social exclusion: Origin and development of the concept of social exclusion	1
20.	Paradigms and domain (gender, ethnicity, class and caste) of social exclusion	1
21.	Socialization: meaning, stages and agents	1
22.	Theories of socialization	1
23.	Social groups: Meaning, types of social groups	1
24.	Social deviance and social control: meaning, types, theories and mechanisms	2
25.	Social problems and means of remedies	1
26.	Social Action: Methods of social work and agricultural professionals as Change Agents;	2
a.	Concepts, importance, types and methods of social work; the concepts of change agents and client groups and the role of agricultural professionals as change agents;	
b.	The principles of professional behaviors of change agents	
Total		30

B. Practical

S.No.	Topic	No.of Practicals
1.	Visit of rural community and identify social research issue	1
2.	Study on urbanization as a phenomenon influencing rural areas	2
3.	Learn about contemporary agriculture and process of globalization	2
4.	Proposal development on study of social research	1
a.	Techniques of data collection (observation and document studying)	1
b.	Techniques of data collection (Focus group discussion, interview)	1
c.	Questionnaire design: types and process	2
d.	Data editing, coding, entry and analysis	2
5.	Report writing	2
6.	Presentation of report	1
Total		15

REFERENCES

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Course Code : EXT 202
Course Title : Fundamentals of Agricultural Extension
Credit Hours : 3(2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES

Upon the completion of this course, the students will understand the basic concept of education and extension education, their principle, philosophy, objective, method, system and practices etc. and apply the agricultural extension knowledge to the farming community.

I. SYLLABUS

Meaning, concept, definition and type of education and extension education, their objective, role in agricultural development, Principle, Philosophy and method of extension education derived from psychology of education and their application to agricultural extension. Historical perspective of extension education and scope of agricultural extension, their system, organizational setup and method used in extension education. Extension teaching learning process, agricultural technology and transfer of technology. Program planning their characteristics, type, level and principle of good program planning process. Identification, characteristics, selection of local leader and their roles in agricultural extension program. Role, function, organizational setup of LGS of Agricultural collage and University in agriculture development. Monitoring and evaluation of extension program.

II. COURSE OUTLINE

A. lecture

S. N.	Topic	No. of Lectures
1.	Meaning, concept, definition, objective of education	1
2.	Formal, Informal and Non-formal education and their nature role and characteristics in development society	1
3.	Meaning, concept, definition of Extension education	1
4.	History of extension education	1
5.	Principle and philosophy of extension education	1
6.	Scope, objective and role of extension in agriculture development	1
7.	Fundamental concept of psychology of teaching learning process, elements	1
8.	Theory, law and principle of teaching learning.	1
9.	Extension teaching method and audio-visual aids, their applic ation in agriculture development different societya. a. Classification of Extension Teaching Methods b. Individual and Group Methods c. Mass Methods and Audio Visual Aids	3
10.	History and present approaches of Agricultural extension in Nepal	1
11.	Contemporary Agricultural Extension Approaches	1
12.	Innovation diffusion process	1
13.	Categories and characteristics of Adopters in innovation decision	1
14.	Major functions of extension in transfer of technology	1
15.	Concept of sustainable agricultural technology	1
16.	Privatization of Agri-Extension: Concept, reasons and role of public private extension system	1

17.	Elements of private extension system and strategies for privatizing extension	1
18.	Basic concept of leader, their types and leadership development	1
19.	Selection, utilization and role of local leader in rural development program	1
20.	Program Planning in Agricultural Extensiona. a. Concept, meaning, scope and objective b. Principle and philosophy c. Type, level and steps of program planning cycle in agriculture	3
21.	Basic concept of monitoring and evaluation of extension program	1
22.	Method, technique and approach in M & E of agriculture development programs	1
23.	Major Institutions Providing Extension/advisory Services in the Country	1
24.	Sharing, linkage and partnership of agricultural extension system services	1
25.	Role, function, organizational setup of Land Grant System (LGS) of University	1
26.	Principle and function of Agriculture College and University in agriculture development.	1
Total		30

B. Practical

S.N.	Topic	No. of Practicals
1.	Preparation of farm level production plan i) crop production ii) Livestock production (simulated)	2
2.	Interaction visit and meeting to study program planning process, plan of work, organizational setup, function and their responsibilities a. DADO/DLS and DIO b. LDO, Financial Institutions c. NARC d. ASC and Farmer's Group	1 1 1 1
3.	Interaction visit and meeting with an I/NGO/CBOs/Co-operatives/ Private sectors and its local group and study their program planning process, plan of work and implementation	1
4.	Preparation of general community level plan of production in field crop, fruits, vegetables and livestock production (selective and simulated)	1
5.	Visit and interaction meeting with commercial farmer's group formed by a. DADO for extension program b. PRA, RRA c. Problem Censing and Problem Solving Techniques	1 1 1
6.	Conducting a village level agricultural Extension Research: (Proposal writing to report presentation)	2
Total		15

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Course Code : EXT303

Course Title : Agricultural Communication

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 basic concept of communication, their principle, method, type system and media preparation etc and ability to apply the agricultural communication knowledge disseminate to the farming community.

I. SYLLABUS

Meaning, concept, definition scope and type of communication, their process, function role in agricultural development. Element, process and model of communication. Feedback, barriers and theory communication its type and approach. Planning for effective communication. Present trend, issues in agricultural communication. Communication in satellite system, role of governmental and non-governmental agencies agricultural communication development.

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lectures
1	Meaning, concept, definition, scope of communication	1
2.	Role / function, process and elements of communication	2
3.	Forms of communication	2
4.	Feedback in communication	1
5.	Models of communication	2
6.	Barriers of communication – Physical, psychological, social and cultural	2
7.	Theories of communication	2
8.	Principles of effective communication	1
9.	Type of communication system a. Individual communication system b. Group and mass communication system c. Audio-visual aids and cone of experience in communication	3
10.	Communication policies linked with national and international agencies	1
11.	Analysis and Planning effective communication in agricultural development	2
12.	Recent strategies of communication in agricultural development	1
13.	Information Communication Technologies (ICT) a. Concept of ICT and its role in agriculture and rural development. b. ICT tools- print and electronic media, social media, e-mail, Internet c. Use of multimedia, use of mobile phone, video and teleconferencing, computer-assisted instructions, web technologies and information booth.	4

14.	New trend and issues in agricultural communication, media - mix	1
15.	Public speaking for effective communication	1
16.	Characteristics and Role of Non-government organization (NGOs) in extension,	1
17.	Role of private, governmental and non-governmental agencies in agricultural communication development	2
18.	Academic and general writing for effective communication	1
Total		30

B. Practical

S.N.	Topics	No. of practical
1.	Graphics in communication – Line, Bar, Pie and pictorial graphs	1
2.	Preparation of various kind of charts – Flow, tree, suspense, flip etc.	2
3.	Preparation of pamphlet, leaflet and booklet	2
4.	Preparation of poster and pictorial book	1
5.	Preparation of radio script, drama and folksong	2
6.	Preparation of powerpoint slides and presentation	2
7.	Communication through bulletin	1
8.	Observation and safety use of projector and film/ movie projector	2
9.	Observation and participation in fair, exhibition, field day, tour etc.	1
10.	Visit different agricultural agencies, local radio and Television station	1
Total		15

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Course Code : EXT 304

Course Title : Social Mobilisation and Community Development

Credit Hours : 3(2+1)

Full Marks: 75

Theory: 50

Practical: 25

OBJECTIVES

Upon the completion of this course the student will know the techniques in developing rural community development programs and the importance of socially organized groups and their mobilization in the developmental activities.

I. SYLLABUS

Meaning and concepts of development, rural development, community development and the transition in thoughts and application of these aspects developmental process over the period of time to current stage in their historical perspectives. Rural poverty, causes and consequences, and efforts made in the past and present strategies, introductory concepts of and recent experiences in poverty reduction programs through various models and processes of social mobilization and participatory program planning at the grassroots level, preparing portfolio of opportunities and investment plans; implementation of plans; participatory monitoring and evaluation; an overview of gender concepts overtime, issues, and strategies in developmental activities, gender sensitive development planning.

II. Course Breakdown

A. Lecture

S. N.	Topic	No. of Lectures
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
5.	Concept of social mobilization, definition, purposes, strategy of implementing social mobilization	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
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
Total		30

B. Practical

S.N.	Topic	No. of Practicals
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	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
Total		15

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AGRICULTURAL STATISTICS

Course Code : AST 201

Course Title : Agricultural Statistics

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 organize and analyze the data and interpret the results. They can design and experiment, analyze it and prepare a report.

I. SYLLABUS

An overview of statistics; sampling methods; measures of central tendency; frequency distribution; presentation and summarization of data; measures of dispersion; probability and probability distributions; correlation and regression; test of significance–Z–test, t-test, and χ^2 –test ; analysis of variance–one–way and two–way and factorial experiments.

II. COURSE OUTLINE

A. Lecture

S.N.	Topics	No of Lectures
1.	Introduction to statistics, Definitions, scope and limitations.	1
2.	Definition of a population, sample; characteristics of a good sample, sampling methods-simple random sampling– sample selection from an agricultural field by simple random sampling, Probability proportional to size, stratified random sampling, systematic sampling, cluster sampling, multistage sampling, sampling error.	2
3.	Measures of central tendency, Definition of Arithmetic mean, Median Mode with merits, demerits and uses, properties of an ideal measure of central tendency, partition values- quartiles, Deciles and percentiles.	2
4.	Frequency Distribution–presentation and summarization of data by different classification methods- Exclusive and inclusive, Diagrammatic– Bar and Pie, and graphical methods- Histogram, Frequency polygon, Frequency curve, O gives (cumulative frequency curves).	2
5.	Measures of dispersion, Range, Quartile deviation, Mean Deviation, Standard Deviation and Variance, Coefficient of variation. Moments- Measures of skewness and kurtosis.	2

6.	Probability – Definitions of random experiment, sample space, events –independent and dependent, trial, mutually exclusive events, exhaustive events, equally likely events, simple and compound events, Definitions of probability (classical and statistical), simple problems based on probability. Addition and Multiplication theorems, conditional probabilities.	2
7.	Probability distributions- Binomial distribution, properties and simple problems, Poisson distribution and its properties and problems. Normal distribution with its properties and problems. Sampling distributions of mean and differences	2
8.	Correlation–Definition, types of correlation, scatter diagram, Karl Pearson’s coefficient of correlation (linear correlation), properties	2
9.	Regression (linear), Regression equations of y on x and of x on y. Relation between correlation coefficient and regression coefficients.	2
10.	Tests of significance–introduction, definition of hypothesis, null and alternative hypotheses, degrees of freedom, levels of significance and types of error. Significance of means–one sample and two sample means in large samples (Z-test).	2
11.	Significance of means in small samples (t-test)- one sample, two samples and two related samples mean test (paired t-test), test for correlation coefficient, F test, χ^2 (chi-square) test–test of independence and goodness of fit.	2
12.	Principles of Field– plot experiments-Replication, Randomization, Local control, one way analysis of variance (completely Randomized Design), Two way analysis of variance (Randomized Block Design), Three way analysis of variance (Latin square Design), and Factorial experiment 2^2 and 2^3 .	9
<hr/> Total		30
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B. Practical

S.N.	Topic	No. of Practicals
1.	Measures of central tendency for ungrouped and grouped data (Arithmetic mean, Median, Mode, Quartiles, Deciles, Percentiles).	1
2.	Classification of data by Exclusive and Inclusive methods, Diagrammatic representation of data by Bar and Pie chart.	1
3.	Cumulative frequency table from raw data and its graphical representation (Histogram, Frequency Polygon, Frequency curve ogives).	1
4.	Measures of dispersion of ungrouped and grouped data (Range, Quartile Deviation, Mean Deviation, standard Deviation/ variance, Coefficient of Variation.	1
5.	Measures of skewness and kurtosis.	1
6.	Simple problems on probability and probability distributions (using the definition of probability, Addition and Multiplication theorems, conditional probability, Binomial, Poisson and Normal distribution).	2
7.	Computation of correlation coefficient and regression equations of Y on X and x on y.	1
8.	Tests of significance of means in large samples (z-test: one sample and two sample means test).	1
9.	Tests of significance of means in small samples [t-test: one sample, two samples and two related samples mean test (paired 't')].	1
10.	F-test: testing of equality of two population variances	1
11.	χ^2 – test: test of independence and test of goodness of fit	1
12.	Analysis of variance – CRD, RCBD, and Latin Square	2
13.	Factorial experiment: 2^2 and 2^3 factorial experiment	1
Total		15

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AGRONOMY

Course Code : AGR 101

Course Title : Principles of Agronomy

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 explain soil and climatic factors in relation to increasing field crop productivity and the basic principles underlying the successful crop production.

I. SYLLABUS

Overview of agriculture and agronomy, weather and climate, tillage, seed and seed quality, cropping system, soil fertility and soil productivity, soil erosion, weed management, irrigation and drainage, crop ideo-type and crop density in relation to successful field crop production.

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lectures
1.	Overview of Agriculture and Agronomy	3
1.1	Definition of Agriculture and Agronomy, subsistence and commercial agriculture, Green Revolution.	
1.2	Relationship of Agronomy to other sciences, role of Agronomist in solving food problem and food security of Nepal.	
1.3	Classification of Agronomical crops based on growing season, Agronomic and special purpose classification.	
2	Weather and climate	3
2.1	Definition of weather, climate, microclimate, meteorology and agro meteorology.	
2.2	Elements of climate: Solar radiation and temperature and their effects on crop growth	
2.3	Precipitation, relative humidity and wind and their effects on crop growth	
3	Tillage	3
3.1	Definition, history, objective of tillage, soil tilth.	
3.2	Types and methods of tillage, primary, secondary and inter tillage.	
3.3	Conventional and conservation tillage and their advantages and disadvantages	
4	Seed and Seed quality	3
4.1	Definition of seed and seed technology, Characteristics of quality seed and its importance.	
4.2	Different classes of seed, seed germination and dormancy	
4.3	seed certification methods in Nepal	

5.	The cropping system	2
5.1	Definition of sole crop, monoculture, cropping pattern, cropping system, farming system, multiple cropping, sequence cropping, inter cropping, mixed cropping, and relay cropping.	
5.2	Definition and method to calculate cropping index, cropping intensity and land equivalent ratio. Crop rotation, principles and advantage of crop rotation.	
6.	Soil fertility and soil productivity	5
6.1	Soil fertility and soil productivity, criteria of essentiality of element, classification of essential elements, forms of elements used by crops.	
6.2	Manures: importance of organic manures, classification and characteristics of different manures including green manure used by Nepalese farmers.	
6.3	Fertilizers: Classification of fertilizers, Nitrogenous, Phosphatic and potassic fertilizers.	
6.4	Biofertilizers: Saprophytes, Symbiotic bacteria, Blue green algae, Azolla, Azotobacter and mycorrhiza.	
6.5	Factor affecting fertilizer use, time and methods of fertilizer applications	
7.	Weed management	3
7.1	Definition, losses and benefits of weeds	
7.2	Classification and management of weeds, prevention, eradication and control.	
7.3	Physical, Cultural, Biological, and chemical methods of weed control with their relative merit and demerit.	
8.	Irrigation and drainage	4
8.1	Role of water, Water requirement, definition and objectives of irrigation.	
8.2	Methods of irrigation: surface, Sub surface, sprinkler and drip irrigation	
8.3	Scheduling of irrigation: Soil moisture depletion approach, IW/CPE approach, Critical stage approach, and pan evaporimeter.	
8.4	Drainage: adverse effect of water logging, types of drainage.	
9.	Soil erosion	2
9.1	Definition of soil erosion, types of water erosion, factor affecting water erosion and losses due to water erosion, conservation practices,	
9.2	Wind erosion, types, factor affecting, losses and control of wind erosion.	
10	Crop ideotype and crop density	2
10.1	Ideotype concept, traits for ideotype, characteristics ideotype of rice, wheat and maize. concept of harvest index,	
10.2.	Crop density, Optimum plant population, factor affecting optimum plant population.	
<hr/> Total		30

B. Practical

S.N.	Topic	No. of Practical
1.	Collection and identification of seeds field crops.	1
2.	Seed purity and germination test	1
3.	Seed rate calculation based on germination and purity and real value of seed.	1
4.	Field preparation and planting seasonal field crops.	1
5.	Identification and nutrient contents of common manures and fertilizers.	1
6.	Calculation of fertilizers and manures.	1
7.	Methods of fertilizer applications in field crops.	1
8.	Identification of common weeds and weed control of field crops.	1
9.	Weed collections and preparations of weed herbarium.	1
10.	Identification of herbicides and herbicide formulations.	1
11.	Calculation of herbicides for application.	1
12.	Study of cropping systems of nearby farms.	1
13.	Calculation of cropping intensity, cropping index and land equivalent ratio.	1
14.	Visit to NMRP, NGLRP and Agronomy farm of AFU.	1
15.	Yield attributes and yield estimation of seasonal field crops.	1
Total		15

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Course Code : AGR 102
Course title : Cereal crops
Credit hours : 3 (2+1) Full marks: 75 Theory: 50 Practical: 25

OBJECTIVES:

Upon the completion of this course, the students will know about improved agronomical practices of cereal crop production and the opportunities, constraints and current research status in cereal crops researches

I. SYLLABUS

Introduction and importance, origin, distribution, area, production and productivity, improved cultural practices, land preparation, recommended varieties, nursery raising methods, seed treatments, seed rate, sowing time, sowing methods, fertilizers, weed and water management, Maturity judging, harvesting, threshing, cleaning, drying and storage, current status of research, yield and constraints and opportunities in rice, wheat, maize, millet, buck wheat and barley

II. COURSE OUTLINE

A. Lecture

S.N.	Topics	No. of Lectures
1.	Rice	10
1.1	Introduction and importance, origin distribution, area, production and productivity in nepal	
1.2	Soil and climatic requirement and their effect on production	
1.3	Morphology, growth and development	
1.4	Taxonomy – indica, japonica and javanica, important varieties and hybrids of rice in Nepal	
1.5	System of rice culture, land preparation and puddling	
1.6	Raising of nurseries: wet, dry, dapog and modified dapog nurseries, seed rate, seed treatment and spacing	
1.7	Mineral nutrition and fertilizer management: N, P, K, zinc, iron and bio-fertilizers, integrated nutrient management, steps for increasing fertilizer use efficiency in rice	
1.8	Water use and water management practices: water requirement, critical stages, Weeds and weed control: crop-weed competition, principles and methods of weed control	
1.9	Maturity judging, harvesting, threshing, cleaning, drying and storage	

2.	Wheat	6
2.1	Introduction and importance, origin, distribution, area, production and productivity, ecologies in Nepal	
2.2	Morphology, growth and development	
2.3	Soil and climatic requirement, classification, important varieties	
2.4	Land preparation, seed treatments, seed rate, sowing time, sowing methods	
2.5	Mineral nutrition and fertilizer management, Water use and water management practices	
2.6	Weeds and weed controls, maturity judging, harvesting, threshing, cleaning, drying and storage	
3.	Rice wheat system in Nepal Coverage, status, factor affecting yield in system, management issues	1
4.	Maize	6
4.1	Introduction and importance, origin, distribution, area, production and productivity in Nepal	
4.2	Soil and climatic requirement, classification, important varieties and hybrids	
4.3	Morphology, growth and development	
4.4	Land preparation, seed treatments, seed rate, sowing time, sowing methods	
4.5	Mineral nutrition and fertilizer management, Water use and water management practices	
4.6	Weeds and weed controls, maturity judging, harvesting, threshing, cleaning, drying and storage	
5.	Finger millet	2
5.1	Introduction and importance, origin, distribution, area, production and productivity	
5.2	Land preparation, seed treatments, seed rate, sowing time, sowing methods, fertilizers, weed and water management, Maturity judging, harvesting, threshing, cleaning, drying and storage	
6.	Buckwheat	1
6.1	Introduction and importance, origin, distribution, area, production and productivity	
6.2	Land preparation, seed treatments, seed rate, sowing time, sowing methods, fertilizers, weed and water management, Maturity judging, harvesting, threshing, cleaning, drying and storage	
7.	Barley Introduction and importance, origin, distribution, area, production and productivity, land preparation, seed treatments, seed rate, sowing time, sowing methods, fertilizers, weed and water management, Maturity judging, harvesting, threshing, cleaning, drying and storage	1
8.	Introduction to minor cereals Sorghum, Perl millet, Foxtail, Proso millet and triticale	1
9.	Current status of cereal research in Nepal	1
Total		30

B. Practical

S.N.	Topic	No. of Practicals
1.	Field preparation for cereal crops	2
2.	Raising of rice seedlings	1
3.	Sowing of cereal crops	1
4.	Study of growth stages of rice, wheat and maize	2
5.	Practices on numerical exercises of fertilizers and pesticides requirements of cereal crops	2
6.	Fertilizer application on the cereal crops	2
7.	Maturity judging of cereal crops	1
8.	Identification and control of major weeds of rice, wheat and maize	1
9.	Yield estimation and harvesting of cereal crops grown during the season	1
10.	Study of plant biometrics of cereal crops	1
11.	Visit and study of various researches conducted at research sites of National Maize Research Program	1
Total		15

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Course code : AGR 203

Couse Title : Grain Legumes and Oilseed Crops

Credit Hours : 2 (1+1)

Full marks: 50 Theory: 25

Practical: 25

OBJECTIVES

Upon the completion of this course, the students will have the knowledge for grain legumes and oil seed crops production

I. SYLLABUS

Introduction, importance and area of production of grain legumes and oil seed crops, lentil and chickpea, pigeon pea, soybean, black gram, rapeseed and mustard, groundnut, sesame, sunflower and linseed.

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lectures
1.	Introduction to grain legumes	3
1.1	Introduction and importance of grain legumes in Nepal	
1.2	Area, production and productivity of grain legumes in Nepal over the years	
1.3	Major problems, present research status and future research strategies to uplift the grain legumes production in Nepal	
2.	Introduction to oil seed crops	2
2.1	Introduction and importance of oil seed crops in Nepal, production and productivity of major oil seed crops in Nepal over the years	
2.2	Major problems, present research status and future research strategies to uplift the oil seed production in Nepal	
3.	Importance, origin and distribution, classification, soil and climatic requirements, land preparation and improved cultural practices, manures and fertilizer application, seed and sowing, recommended varieties, weed and water management, harvesting, threshing, yield and storage of grain legumes and oil seed crops	10
3.1	Lentil	
3.2	Chickpea	
3.3	Pigeon pea	
3.4	Soybean	
3.5	Moong bean and black gram	
3.6	Rape seed and mustard	
3.7	Ground nut	
3.8	Sesame	
3.9	Sunflower	
Total		15

B. Practical

S.N.	Topic	No. of Practical
1.	Identification of various grain legumes grown in Nepal	1
2.	Identification of various oil seed crops grown in Nepal	1
3.	Morphology and phenology of grain legumes	1
4.	Morphology and phenology of grain legumes	1
5.	Field preparation for grain legumes	1
6.	Field preparation for oil seed crops	1
7.	Calculation of seed required for the sole and intercropping system with legumes and oil seed crops	1
8.	Calculation of fertilizer required for the sole and intercropping system with legumes and oil seed crops	1
9.	Seed inoculation of grain legumes	1
10.	Seed treatment of oil seed crops	1
11.	Sowing of grain legumes crop varieties	1
12.	Sowing of oil seed crop varieties	1
13.	study of root nodules and nodulation behavior of some grain legumes	1
14.	Study of legumes and oil seed in cropping system	1
15.	A visit to NGLRP, Rampur, Chitwan	1
Total		15

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2. Rethore, P. S. 1999. Techniques and management of field crop production. Agrobios, Jodhpur, India
3. Thakur, C. 1979. Scientific crop production. Vol 1 and 2. Metropolitan Book Co. Pvt. Ltd., New Delhi

Course Code : AGR 204

Course title : Commercial Crops

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 know about the principles and practices of common commercial crop production with respect to Nepalese Agriculture..

I. SYLLABUS

Importance, origin, history, distribution, yield, soil and climatic requirements, improved cultural practices: land preparation, crop rotation, manure and fertilizer application, recommended varieties, seeds and sowing, intercultural operations, water and weed management, harvesting, storage, current status of research, constraints and opportunities of the following crops with reference to Nepal; Sugar crops- sugarcane, Fiber crops-jute and cotton, narcotic crops-tobacco, Tuber crops-potato.

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lectures
1.	Tobacco	6
1.1	Economic importance, distribution, yield and ecology - relation to temperature, moisture, light and soil	
1.2	Raising tobacco seedlings and their transplanting	
1.3	Fertilizer management: effects of N, P and K on growth and development and dosing, timing and methods of application of NPK fertilizers	
1.4	Plant management: soil loosening, weeding, irrigation, topping and desuckering	
1.5	Methods of harvesting, curing: definition and methods: Flue curing.	
1.6	Air curing, Fire curing and sun curing	
2.	Potato	5
2.1	Economic importance, distribution, yield and ecology - relation to temperature, moisture, light and soil	
2.2	Seed and sowing: requirements of good seed, seed preparation, seed treatment, dormancy	
2.3	Planting time, seed rate, seed size and spacing, methods of planting	
2.4	Fertilizer management: effects of N, P and K on growth and development and dosing, timing and methods of application of NPK fertilizers	
2.5	Plant management: Soil loosening, earthing up, weeding, irrigation, and haulm pulling. Harvesting and storage.	

3.	Jute	5
3.1	Economic importance, distribution, yield and ecology - relation to temperature, moisture, light and soil	
3.2	Fertilizer management: effects of N, P and K on growth and development and dosing, timing and methods of application of NPK fertilizers	
3.3	Sowing of jute, plant management: gap filling, hoeing, weeding, thinning, irrigation	
3.4	Harvesting and post harvest operations including steeping, retting and extraction	
3.5	Jute fiber and its defects.	
4.	Sugarcane	8
4.1	Economic importance, distribution, yield and ecology - relation to temperature, moisture, light and soil	
4.2	Planting materials, types of planting materials, planting time seed selection, seed preparation and treatment	
4.3	Planting methods: Flat, Furrow, Ridge and furrow, Trench, Deep trench	
4.4	IISR8626, spaced transplantation technique and Ring or pit	
4.5	Fertilizer management: effects of N, P and K on growth and development and dosing, timing and methods of application of NPK fertilizers	
4.6	Plant management: intercropping, earthing up, weeding, irrigation, detrashing, propping and tying and harvesting	
4.7	Ratoon management: definition, extent of ratooning, yield, reasons for low yield from ratooning and advantages	
4.8	Ratoon management: Variety, plant crop and harvest, time of harvest, method of harvest, stubble shaving, shoulder breaking, fertilizer application and water management	
5.	Cotton	6
5.1	Economic importance, distribution and yield	
5.2	Ecology - relation to temperature, moisture, light and soil	
5.3	Cotton fiber and its quality: staple length, fineness, strength and ginning percentage.	
5.4	Seed preparation and sowing.	
5.5	Fertilizer management: effects of N, P and K on growth and development and dosing, timing and methods of application of NPK fertilizers.	
5.6	Plant management: crust breaking, thinning, weeding, irrigation, topping, defoliation, and desiccation. Harvesting and Gossypol.	
<hr/> Total		30
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B. Practical

S.N.	Topic	No. of Practical
1.	Classification and morphological characteristics of tobacco.	1
2.	Differences between two species of tobacco.	1
3.	Raising tobacco seedlings.	1
4.	Classification and morphological characteristics of potato	1
5.	Morphology of potato tuber.	1
6.	Classification and morphological characteristics of sugarcane including noble cane and nobilization.	1
7.	Numerical problems in relation to seed rate yield estimation and commercial cane sugar (CCS).	1
8.	Classification and morphological characteristics of cotton.	1
9.	Branching and flowering in cotton.	1
10.	Characteristic of cotton species.	1
11.	Numericals problem related with fertilizers dose, yield estimation and seed rate of cotton.	1
12.	Classification and morphological characteristics of jute.	1
13.	Differences between two species of jute.	1
14.	Fibre layers in jute.	1
15.	Analysis of boll weight of cotton/ statistical analysis of crop yield.	1
Total		15

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Course Code : AGR 305

Course Title : Principles and Practices of Seed Technology

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

OBJECTIVES

Upon the completion of this course, the student will be able to know, skills and basic concepts of seed production technologies of some important crops.

I. SYLLABUS

Seed as basic unit of crop production, seed, fruit, grain, propagating materials; seed development process and factor affecting it, seed dormancy, germination and quality seed and factor affecting it, seed longevity; types of seed and their multiplication techniques, certification and distribution, National and International organization involved in seed, seed law, farmer's seed and Intellectual property right.

II. COURSE OUTLINES

A. Course outline

S. N.	Topics	No. of Lecture
1	Fruits, grains, seed and seed materials	1
2	Seed formation and development	1
3	Factors affecting seed development	1
4	Seed dormancy and methods of breaking it	1
5	Seed germination and its pattern	1
6	Seed vigor and its role in crop establishment	1
7	Quality seed and factors affecting it	1
8	Types of seed and their production	1
9	Seed longevity and causes of seed deterioration	1
10	Harvesting and threshing	1
11	Seed cleaning, drying and storage	1
12	Basic principles of seed production	1
13	Seed certification	1
14	Seed distribution system in Nepal	1
15	International Seed Testing Association and National Seed Law	1
Total		15

B. Practical

S. N.	Topic	No. of practicals
1	Identification of seeds of various field crops	1
2	Measurements of Agronomical Characteristics of Crop Seeds	1
3	Study of the differences in Agronomical Characteristics of Different Varieties of Rice, Maize, Wheat, Grain Legumes, Oil seeds, Potato and Others crops	6
4	Practice on Seed Purity Test	1
5	Practice on Seed Viability Testing	1
6	Practice on Seed Germination Test in Lab and Field	1
7	Practice on Seed Vigor Testing	1
8	Methods Preparations of Seeds for Planting	1
9	Tour to Seed Processing Plant and Seed Testing Laboratory Hetauda	1
10	Visit to Seed Multiplication Farms of National Maize Development Research Rampur and National Grain Legume Research Station Rampur	1
Total		15

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Course Code : AGR 306

Course title : Weed Science

Credit hours : 2 (1+1) Full marks: 50

Theory: 25

Practical: 25

OBJECTIVES:

Upon the completion of this course, the students will be able to know the skill and scientific weed management principles and practices of common field crops.

I. SYLLABUS

Definition, characteristics, classification, dispersal of weed, losses caused and economic importance of weeds, competition between crops and weeds; concept of prevention, eradication and control, weed control methods, introduction to herbicides, mode of action of herbicides, herbicides and environment, and weed ecology.

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lectures
1.	Weed: concept, definition and economic importance	2
	1.1 Definition of weed, classification, dispersal of weed	
	1.2 Loss caused by weed and beneficial aspects of weeds	
2.	Characteristics of weeds Dormancy, viability and germination; growth habit; reproduction and multiplication; persistence and tolerance/resistance	1
3.	Crop weed competition Crop-weed interference and general principles; Different factors of competition (nutrients, water, light, space), Allelopathy	1
4.	Concept and method of weed control	6
	4.1 Concept of weed control: prevention, eradication, control and management	
	4.2 Physical and cultural methods and approaches of weed control	
	4.3 Biological methods and approaches of weed control	
	4.4 Chemical methods and approaches of weed control	
	4.5 Biotechnological approaches of weed control	
	4.6 Integrated weed management: definition, concept and practices	
5.	Herbicides	4
	5.1 Definition; characteristics of ideal herbicides; usefulness and limitation of herbicides	
	5.2 Classification of herbicides: based on time of application, selectivity, site of application	
	5.3 Mode of action of herbicides	
	5.4 Herbicides and environments	
6.	Weed ecology	1
Total		15

B. Practical

S.N.	Topic	No. of Practicals
1.	Identification of weeds	1
2.	Survey of weeds in crop fields and other habitats	2
3.	Critical period of crop weed competition	1
4.	Herbarium preparation of weeds	1
5.	Estimation of weed density, weed control efficiency and weed index	1
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
11.	Field study and control of problematic weeds–sedges, bermuda grass or parasitic weeds	1
12.	Economics of weed control practices	1
Total		15

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ANIMAL SCIENCE

ANIMAL SCIENCE

Course Code: LPM 101

Course Title: Introductory Animal Science

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

OBJECTIVES

Upon the completion of the course, the students will be able to understand the domestication of farm animals and avian species; they will also be able to know general husbandry practices of farm animals and avian species.

I. SYLLABUS

Introduction, commonly used terms of animal husbandry and poultry. Importance, scope and constraints of livestock and poultry farming in Nepal. Zoological classification of farm animals and poultry birds. Most common breeds of farm animals and poultry birds. Differences between ruminants and non-ruminants animals. Common housing system of farm animals and poultry. Identification ageing, weighing, castration, dehorning/debudding of farm animals. Restraining and handling of farm animals. Marketing and transportation of farm animals and poultry. Importance and types of farm record. Sign of good health, factor affecting health of farm animals. Stress amelioration practices of farm animals. Care and management of different categories of farm animals. High mountain animals, characteristics, management and feeding. Importance of barn sanitation and waste handling. Conservation practices of forage, use of NPN in ruminant feeding.

II. Course Outline

A. Lecture

S.N.	Topic	No. of lectures
1.	Introduction, commonly used terms of animal husbandry and poultry.	1
2.	Importance, scope and constraints of livestock and poultry farming in Nepal.	1
3.	Zoological classification of farm animals and poultry birds	1
4.	Most common breeds of farm animals and poultry birds? Breeds of cattle, buffalo, sheep, goat, swine and poultry (Holstein friesian, Jersey, Brown-swiss, Ayrshire, Haryana, Sahiwal, Red sindhi, Lulu, Achhami, Siri, Pahadi, Murrah, Jaffarabadi, Nilli ravi, Surti, Mehsana, Lime, Parkote, Gaddi, Merino, Rambouillet, Polworth, Leicester, Lincoln, Kage, Lampuchhre, Baruwat, Dhorel, Bhyangulung, Hampshire, Saanen, Toggnberg, Jamunapari, Barberi, Beetal, Black Bengal, Teraigoat, Khari, Sinhah, Chyangra, Yorkshire,	6

	Landrace, Duroc, Tameworth, Hurra, Bampudke, Pakhribas black, Plymouth rock, RhodeIsland Red, New Hampsire, Australorp, Sussessex, Leghorn, Sakini, Pwankh ulte, Naked neck.)	
5.	Differences between ruminant and non-ruminant animals	1
6.	Common housing system of farm animals and poultry	2
7.	Identification ageing, weighing, castration, dehorning/disbudding of farm animals	3
8.	Restraining and handling of farm animals.	1
9.	Marketing and transportation of farm animals and poultry	2
10.	Importance and types of farm record	1
11.	Sign of good health, factor affecting health of farm animals	1
12.	Stress amelioration practices of farm animals	2
13.	Care and management of different categories of farm animals? Newly born calves, pregnant, lactating animals, bullock, breeding bull and sick animal	3
14.	High mountain animals, characteristics, management and feeding (yak, Nak, Chauri, Mule and Donkey)	2
15.	Importance of barn sanitation and waste handling	1
16.	Conservation practices of forage, use of NPN in ruminant feeding	2
Total		30

B. Practical

S.N.	Topic	No of practicals
1.	Study of commonly used lab equipments	1
2.	Identification of external body parts/points of farm animals and poultry birds	2
3.	Identification/numbering of farm animals and poultry.	1
4.	Identification of breeds of farm animals and poultry	2
5.	Castration of farm animals	1
6.	Dehorning/disbudding of farm animals	1
7.	Estimation of body weight through body measurement of farm animals	1
8.	Age determination by dentition of farm animals	2
9.	Casting and handling of farm animals	1
10.	Differences between layers and loafers	1
11.	Study of different types of farm records	1
12.	Cleaning and disinfection of animals barn	1
Total		15

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Thomas, C.K., N.S.R. Sastry and R.A. Singh, Livestock Production and Management, Kalyani Publishers, India

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

Course Code : LPM 102

Course Title : Ruminant Production

Credit Hours : 2(1+1) Full Marks: 50

Theory: 25

Practical: 25

OBJECTIVES

Upon the completion of this course, the students will be able to identify different breeds of farm animals and have knowledge on management practices.

I. SYLLABUS

Breeds of cattle, buffalo, sheep and goat. Care and management of cattle, buffalo, Sheep and goat. Housing principles and types of housing for ruminants. Artificial rearing of newborn calves, kids, lambs. Feeds and feeding of ruminants. Castration, dehorning, grooming, dipping, dusting, shearing of wool, Judging and selecting of farm animals. use of draft animals. Milking methods and practices.

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lectures
1	Introduction ,scope and statistics of ruminants	1
2	Prominent breeds and characteristics of buffalos	2
3	Prominent breeds and characteristics of cattle	1
4	prominent breeds and characteristics of sheep	1
5	Prominent breeds and characteristics of goats	2
6	Care and management of cattle, buffalo, sheep and goat (Pregnant and lactating)	1
7	Housing principles and housing of ruminants	1
8	Artificial rearing of new born ruminants	1
9	Importance and methods of castration, dehorning, groomingdipping, and dusting of farm animals.Shearing of wool, grading quality of wool.	2
10	Judging and selection of animals	1
11	Uses of draft animals	1
12	Milking methods and practices	1
Tota		15

B. Practical

S.N.	Topics	No.of Practicals
1.	Study different type of housing system on a farm	2
2.	Castration of bull, goat and ram	3
3.	Dehorning of buffalo and cattle	2
4.	Grooming of cattle and buffalo	1
5.	Cleaning the barn and milking par lour	1
6.	Milking practices	2
7.	Preparation of milk production record and other farm records	2
8.	Identification, characterization and familiarization with different breed of cattle, buffalo, sheep and goats	2
Total		15

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Ross, C.V. 1989 or Latest, Sheep Production and Management. Published by Prentice Hall, Inc New Jersey, 07632 USA.

Course Code : LPM 203

Course Title : Pig and Poultry Production

Credit Hours : 2 (1+1)

Full Marks: 50

Theory: 25

Practical: 25

OBJECTIVES

Upon the completion of this course, the students will be able to identify different breeds, feed, and manage pigs and poultry.

I. SYLLABUS

Prominent breeds of pig, care and management and feeding of different age groups of swine, Housing systems, materials used and spacing required, commonly used managerial practices. Prominent indigenous and commercial breeds of broilers and layers, Rearing and feeding of broilers and layers at different stages of growth, Housing systems, requirements and materials required and design of houses. Egg formation, Selection of eggs for incubation. Factors essential for Hatching. Brooding methods, Common managerial practices, Vaccination, debeaking, candling, sexing, selection, grading of eggs. Selection and culling of layers. Bio-security in a commercial farm.

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lectures
1.	Introduction, Scope and statistics of pig and poultry	1
2.	Care and management of newborn pigs	1
3.	Care and management of pregnant sow and breeding boar	1
4.	Housing systems, and materials essentials for housing swine	1
5.	Commonly used managerial practices of poultry	1
6.	Breeds characteristics of pigs (Landrace, Yorkshire, Tamworth, Durock etc.)	2
7.	Breeds of poultry (layers, broilers and dual purpose)	2
8.	Materials and design of poultry housing.	1
9.	Hhhjs Egg formation , Selection of eggs for table purpose & incubation	1
10.	Factors essentials for best hatching	1
11.	Brooding methods (natural and artificial)	1
12.	Common managerial practices for broilers and layers	1
13.	Bio-security in a commercial farm	1
Total		15

B. Practical

S.N.	Topics	No. of Practicals
1.	Identification of different breeds of swine	1
2.	Housing and feeding of swine	1
3.	Identification (tagging, and ear notching) of swine	1
4.	Castration of pig, iron administration and vaccination of swine	2
5.	Identification of broiler and layer breeds	2
6.	Methods of putting identification marks on poultry	1
7.	Disease identification, vaccination and control of diseases	2
8.	Debeaking, candling, grading and selection of eggs	2
9.	Identification of layers and broilers	1
10.	Feeding and watering of poultry	2
Total		15

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Banerjee, G.C. 1991. A Text Book of Animal Husbandry. Oxford and IBH Publishing, New Delhi. (7th edition)

Banerjee, G.C. 1998 Feeds and Principles of Animal Nutrition, Oxford and IBH Publishing, New Delhi

Banerjee, G.C. 1995 Poultry. Oxford and IBH Publishing, New Delhi

Arora, S.P. and Kaur, Harjit (2005). Principles of Animal Nutrition and Nutrients Dynamics. ICAR, New Delhi.

Cheeke, Peter R. (1999) Applied animal Nutrition: Feeds and Feeding. Second Edition. Prentice Hall Upper Saddle River

Course Code : ANU 201

Course Title : Animal Nutrition and Feeding Practice

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 know functions, deficiency symptoms of nutrients and feeding of farm animals.

I. SYLLABUS

Terminology of animal nutrition, feedstuffs classification, comparative composition of plants and animals cells and tissues. Classification, functions and deficiency symptoms of carbohydrates, protein, lipids, minerals and vitamins. Digestion, absorption and metabolism of nutrients in ruminants and non-ruminants. Importance of proximate analysis, feeding standards and nutrient requirements for different farm animals and poultry .Feeding of cattle, buffalos, sheep, goats and poultry

II. COURSE OULINE

A. Lecture

A. Theory

S.No.	Topic	No. of Lectures
1.	Introduction, importance and terminology of animal nutrition	1
2.	Feedstuffs classification	1
3.	Comparative composition of plant and animals cells and tissues	2
4.	Classification, functions and deficiency systems of carbohydrates	2
5.	Classification, functions and deficiency systems of protein	2
6.	Classification, functions and deficiency systems of lipids	1
7.	Classification, functions and deficiency systems of minerals	3
8.	Classification, functions and deficiency systems of vitamins	2
9.	Digestion of carbohydrates in ruminant and non-ruminant	2
10.	Digestion of protein in ruminant and non-ruminant	2
11.	Digestion of lipids in ruminant and non-ruminant	2
12.	Metabolism and absorption of nutrients	3
13.	Importance and method of proximate analysis	1
14.	Feeding standards for cattle, buffalo, sheep and goats	2
15.	Feeding standard for swine and poultry	1
16.	Feeding of large ruminants (cattle and buffalo)	1
17.	Feeding of small ruminants (sheep and goats)	1
18.	Feeding of swine and poultry	1
Total		30

B. Practical

S.N.	Topic	No of practicals
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 feeds and common fodder	2
5.	Determination of crude protein	2
6.	Determination of NDF and ADF	2
7.	Computation of feeds for cattle and buffalo	1
8.	Computation of feeds for sheep and goats	1
9.	Computation of feeds for swine	1
10.	Computation of feeds for poultry (broiler and layers)	2
Total		15

REFERENCES

Banarjee, G.C. 1986. A Text Book of Animals Nutrition, Published by Mohar Primlani, Oxford and IBH Publishing CO. Pvt. Ltd.

National Research Council (NRC, 2011), Nutrient requirements of Dairy Cattle, Published Washington D.C.

National Research Council, (NRC, 2011) Nutrient requirements of poultry, Published Washington D.C.

National Research Council, (NRC,2011), Nutrients requirements of swine Published Washington D.C.

National Research Council, (NRC, 2011), Nutrient requirements of sheep and goats. Published Washington, D.C.

Course Code : ANU 302

Course Title : Fodder Production and Pasture 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 know about the fodder production including cultivation practices, major fodder and pasture species grown and their management considering its practical application.

I. SYLLABUS

Introduction: terminology related to 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. Cultivation practices of common annual and perennial fodder grasses and legumes. Common pasture species and their management. Pasture establishment, and nutrition of grazing animals. Preservation of fodder.

II. Course Breakdown

A. Lecture

S.N.	Topic	No.of Lectures
1.	1.1 Introduction; feeds and feeding situation in Nepal	1
	1.2 Common terminology of fodder and pasture	1
2.	2.1 Edaphic factors affecting pasture and fodder crops	2
	2.1.1 Climate and its variation	
	2.1.2 Soil types	
	2.2 Factors associated with fodder production	2
	2.2.1 Chemical composition and nutritive value	
	2.2.2 Species and varietal differences	
3.	3.1 Fodder plant growth, development and yield	1
	3.2 Morphology of forage grasses: vegetative grass tiller, and reproduction growth in forage grasses	1
4.	Cultivation practices of common annual and perennial fodder grasses (Oats, Jawar, Bajar, Teosinte, Maize, Napier, Blue panic, Molases, Mulato, Para grass, Signal grass)	7
5.	Cultivation practices of common annual and perennial fodder legumes (Siratro, Centrocema, Berseem, Lucern, Joint vetch, Desmodium, Stylosanthes, Forage peanut, Butterfly pea and Glycine)	4
6.	Cultivation, establishment and yield of common pasture species (Perennial ryegrass, Cocksfoot, Tall fescue, phalaris, White clover, Red clover, Lotus and Low fertility grasses)	5

7.	7.1 Pasture establishment; seed quality, sowing, soil environment	1
	7.2 Cultivated seed beds and management of pasture Nutrition of grazing animals; nutritive value of pasture, herbage intake and composition	1
8.	8.1 Preservation and conservation of fodder/ forage	1
	8.1.1 Hay making, steps, advantage and disadvantage	1
	8.1.2 Silage making, process, steps, advantage and limitations	1
Total		30

B. Practical

S.N.	Topics	No.of Practicals
1.	Common features used in identifying vegetative grasses	1
2.	Identification of seasonal fodders (grasses and legumes)	1
3.	Identification of some common pasture grasses	1
4.	Identification of some common pasture grasses	1
5.	Identification of common fodder trees and common tree fodder	1
6.	Preparation of herbarium sheet	1
7.	Cultivation of seasonal fodder covering winter and summer seasons	2
8.	Forage fodder sampling	2
9.	Proximate analysis	3
10.	Determination of green and dry matter yield	1
11.	Determining/estimating botanical composition of the pasture mass	1
Total		15

REFERENCES

- Banarjee, G.C. 1986. A Text Book of Animals Nutrition, Published by Mohar Primlani, Oxford and IBH Publishing Co. Pvt. Ltd.
- Bayer, W. and A.W. Bayer. 1998. Tropical Agriculture Forage Husbandry. ICAR, MacMillan.
- Devkota, N.R. 2005. A Practical Manual on Basics of Pasture Research and Study. Devkota and Devkota Family Publishing, Kathmandu, Nepal. P50.
- Pandey, R.S. 1997. Fodder and Pasture Development in Nepal. Udaya R.D. Service (p.) Ltd. Kathmandu Nepal.
- Pandey, K.K. 1982. Fodder Tree and Tree Fodder in Nepal. Swiss Federal Institute of Forestry Research. Birmensdorf, Switzerland.
- Pathak, N.N. and R.C. Jakhmilla. 1983. Forage and Livestock Production. Bikash Publishing House. New Delhi.

Course Code : ANB 301

Course Title : Principles and Practices of Animal Breeding

Credit Hours : 3(2+1)

Full Marks: 75

Theory: 50

Practical: 25

OBJECTIVES

Upon completion of this course, the students will be able to understand basic principles and fundamentals of animal breeding and application of animal breeding techniques to improve the breeds of different species.

I. SYLLABUS

Animal breeding, important and its scope in livestock improvement. Animal genetic resources and sustainable development of indigenous breeds. Rare breeds of different species of animals and their characteristics and economic values, reason for being endangered, strategies and methods for conservation of AnGR, Variation and causes of variation, important of heredity and environment. Gene action (additive and non additive). Concept of heritability and repeatability. Selection, selection response, selection limit, selection differential, methods and basis of selection, mating system, inbreeding and out breeding. Concept of genetic resistance to disease and parasites. Traits of economic importance of different livestock species. Biotechnology in animal breeding, Nuclear transplantation, transgenic animal production and its significance in genetic improvement of livestock.

Practical: Estimation of heritability and repeatability, means, breeding values and components of variances, calculation of inbreeding relation and coefficient, selection response, selection differential, genetic gain, probable breeding value, most probable producing ability, selection intensity and selection index.

II. COURSE OUTLINE

A. Lecture

S.N.	Topics	No.of Lectures
1.	Introduction, history and important of animals breeding	2
2.	Animal genetic resource and sustainable development	2
3.	Important of indigenous breed and economic values	2
4.	Rare breeds of different species of animals and their characteristics	2
5.	Reason for being endangered, strategies for conservation	2
6.	Variation and causes of variation	2
7.	Importance of heredity and environment	2
8.	Concept of heritability and repeatability	2
9.	Selection (principal, basis, method, selection parameters)	2
10.	Mating system (inbreeding, out breeding)	2
11.	Concept of Genetic resistance to diseases and parasites	2
12.	Important Economic traits of livestock and poultry	2
13.	Transgenic animals and their production	2
14.	Animals biotechnology and recent advance in animals biotechnology	4
Total		30

B. Practical

S.N.	Topics	No.of Practicals
1.	Estimation of heritability by using regression and correlation	1
2.	Estimation of heritability by using twin comparison and selection	1
3.	Estimation of heritability by one way and nested design	2
4.	Estimation of repeatability	1
5.	Estimation of variance components and means	2
6.	Breeding value, PBA, MPPA	2
7.	Calculation of inbreeding relationship and coefficient	2
8.	Estimation of selection parameters, selection index	2
9.	Livestock farm data analysis and report writing	2
Total		15

REFERENCES

- Rendel I. J. Genetics and Animal Breeding. W.H. Freeman and Company.USA
- Lasley, J.F., 1988. Genetics of Livestock Improvement 3rd edition. Prentice-Hall. Inc., Englewood Cliffs, New Jersey.
- Lush J. L.1960.Animal Breeding Plans.Iowa State University Press, Ames, Iowa.
- Nicholl, D.S.T. 1994. An introduction to genetic engineering. Cambridge University Press.
- Stufflebeam C.E. 1989.Genetics of Domestic Animals. Prentice Hall, Englewood Cliffs, New Jersey
- Warick and Legates, 1979. Breeding and Improvement of Farm Animals.
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- Warwick and Legates, 1979. Breeding and Improvement of Farm Animals.
- Johansson, I. And Rendel J.1968. Genetics and Animal Breeding.

Course Code : LPM 304
Course Title : Introductory Dairy Science
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 collect samples, test and standardize milk and milk products.

I. SYLLABUS

Introduction, Dairying in Nepal, Its scope and comparison with developed countries. Milk: Definition of milk, and diagrammatic representation of milk constituents, composition of milk, factors affecting the composition, nutritive values and physical and chemical properties of milk. Physiology of lactation Mammary gland and hormones related to development of udder, milk secretion and letdown of milk. Milking: Method of milking, clean milk production, importance and factors affecting the clean milk production, Flavor defects in milk, Dairy microbiology: Types of M. O., their sources of contamination, uses and significance of M. O. in dairy industry.

II. COURSE OUTLINE

A. Lecture

S.N.	Topics	No.of Lectures
1.	Introduction to course outline and evolution system	1
2.	Dairying in Nepal and its Scope	1
3.	Comparison of Nepalese dairy with that of developed countries	2
4.	Milk: Definition, and diagrammatic representation of milk constituents	1
5.	Composition of milk (fat, lactose, protein, energy, vitamins and minerals)	2
6.	Nutritive value of milk	1
7.	Physical and chemical properties of milk	2
8.	Factors affecting the composition of milk	2
9.	Physiology of lactation: Mammary glands and hormones related to development of udder	2
10.	Milk secretion and letdown of milk	3
11.	Milking: Methods of milking: hand milking vs. machine milking	1
12.	Clean milk production: Importance and factors affecting the clean Milk production	1
13.	Natural flavors and off flavors of milk	1
14.	Flavor defects in milk and their prevention measures	1
15.	Dairy microbiology: Brief outline	1
16.	Types of microorganism found in milk	1
17.	Sources of contamination in milk	1
18.	Uses of beneficial microorganism in milk	2
19.	Significance of microorganism in dairy industry	1
20.	Preparation of common dairy products (Dahi, Cheena, Khoa, Paneer, and ice cream)	3
Total		30

B. Practical

S.N.	Topics	No. of Practicals
1.	Study of commonly used dairy equipments	1
2.	Study of milk sampling procedures	1
3.	Sediment test by using disc and sediment tester	1
4.	Estimation of fat by Gerber's method	1
5.	Estimation of specific gravity, SNF and T.S in milk	1
6.	COB and titrable acidity test in milk	1
7.	Study of MBR test for assessing microbiological quality of milk	1
8.	Study of mammary gland and physiology of lactation	2
9.	Study and practices of hand milky	1
10.	Estimation of M.O.by using microscopes and CMT paddle	2
11.	Preparation of Dahi, Cheena, Paneer, and Khoa	2
12.	Standardization of milk and cream	1
Total		15

REFERENCES

Clarence, H.E., W.B. Combs and H.Macy.1994.Milk and Milk Products.TATA Mc Graw Hill Publishing Co.Ltd, India

Sukumar, De 2000.Outlines of Dairy Technology, Oxford University.Press India

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

Course Code : ANU 403

Course Title : Applied Human Nutrition

Credit Hours : 2 (2+0)

Full Marks: 50

Theory: 50

Practical: 0

OBJECTIVES

Upon the completion of this course, the students will be able to recognize nutrients deficiency diseases occurring in human body and they will be aware of maintaining good health.

I. SYLLABUS

Nutrition and human health: Human health needs, Major Nepalese health problems; Nutritional guides for health promotion, Nutrition guidelines for prevention of heart diseases and Cancer, Relation of food and nutrition to health. Food classification, bioactive phytochemicals in food and their mechanism of action to promote human health. Role of Carbohydrates, Proteins, Lipids, Minerals and Vitamins in human body. Nutritional deficiency disorders in human body: Protein-energy malnutrition, causes of malnutrition. Method to solve malnutrition problems., naturally occurring toxicants' in foods. Chemicals contamination in foods.

Foods fortification: principles and applications .Nutrition improvement program in Nepal. Food processing, effect of food processing on nutritional status. Water, electrolyte and mineral balance.

Diet, nutrition and digestive disease (coronary heart disease, diabetes mellitus; cancer, gastro-intestinal problem, renal disorders, urolithiasis, food factors and cataract).

II. COURSE OUTLINE

A. Lecture

S.N.	Topics	No.of Lectures
1.	Nutrition and human health, human health needs major Nepalese health problem.	1
2.	Nutritional guides for health promotion: cancer and heart disease, Foods and their classification	2
3.	Relation of food and nutrition to health	1
4.	Nutrition and ageing, nutrition and mental function, weight control, nutrition and cancer, heart disease and diabetes mellitus	2
5.	Bioactive phytochemicals in foods and their mechanism of action to promote health	1
6.	Carbohydrates: Classification, Dietary fiber and its role. Physiologic effects of dietary fiber. Dietary fiber, recommendation, Special functions of carbohydrates in body tissues.	3
7.	Lipids: Classification, functions, requirements and food sources, cholesterol and its role to Promote human health. Cholesterol and health concern	3

8.	Proteins: Essential and non- essential amino acids, functions of proteins, proteins requirement Factors affecting protein requirement, protein turnover, functions of dietary protein. Measure of protein requirements, deficiency symptoms of proteins	3
9.	Minerals: Major and Minor minerals functions of minerals in human body. Deficiency Symptoms and food sources	3
10.	Water, electrolyte and mineral balance	2
11.	Energy metabolism and physical work performance, factors influencing basal metabolism, Energy requirements for various physiological functions	2
12.	Nutritional deficiency disorders: Protein -energy malnutrition, causes of malnutrition, Methods to solve malnutrition, governments strategy to solve malnutrition	2
13.	Food toxicities: Naturally occurring toxicants' in food, chemical contaminants in foods.	1
14.	Food processing: Effect of food processing on nutritional status	1
15.	Diet, nutritional and degenerative disease (a) Coronary heart disease (b) Diabetes mellitus (c) Cancer (d) gastro- intestinal problems (e) Rent disorders (f) Urolithiasis (g) Food factors and Cataract.	3
<hr/> Total		30

REFERENCES

Sue Rod Well Williams, 1989. Nutrition and Diet Therapy, Times Mirror / Mob by College Publishing, St. Lous, Toronto, Boston , Losaltos -

Mahatab and Bamji N. Pralhad Rao. Vinodini Reddy, Vinodini Reddy: 1986. Text Book of Human Nutrition, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi, Calcutta,.

Course Code : VMC 401

Course Title : Animal Health

Credit Hours : 3 (2+1)

Full Marks: 75

Theory: 50

Practical: 25

OBJECTIVES

Upon completion of this course, the student will be able to know the common bacterial, fungal, viral and parasitic diseases prevalent in livestock, poultry and pet animals.

I. SYLLABUS

Terminologies related to health and disease, Sign of health and diseases, History taking physical examination, Classification of diseases, Modes of disease transmission, Definition, etiology, symptoms, diagnosis, treatment, control and prevention of common bacterial, viral and parasitic diseases. Causes, symptoms and treatment of metabolic and reproductive diseases. Importance of Zoonotic diseases in Nepal.

II. Course outline

A. Lecture

S.N.	Topic	No. of Lectures
1	Terminology related to health and disease	1
2	Sign of health and diseases	1
3	History taking physical examination	2
4	Classification of diseases	1
5	Modes of disease transmission	1
6	Bacterial diseases: HS, BQ, Anthrax, Mastitis.	5
7	Viral diseases: FMD, PPR, Swine fever, canine distemper, rabies	4
8	Protozoal diseases: Babesiosis, Coccidiosis,	2
9	Parasitic diseases: Liver fluke, Ascariasis, Tapeworm	3
10	Production diseases: Milk fever,	1
11	Poultry diseases: pullorum, Newcastle disease, IBD, Marek's disease,	6
12	Anestrous	1
13	Dystokia	1
14	Zoonotic diseases	1
Total		30

B. Practicals

S.N.	Topic	No. of Practicals
1	Methods of taking temperature, pulse and respiration rate.	2
2	History taking	1
3	Routine test of urine	1
4	Vaccination on Livestock species (Cattle, Buffalo, Sheep, Goat, Equine, and Poultry)	4
5	Diagnosis of different parasitic diseases.	3
6	Test of blood for TLC, DLC and Hb estimation.	3
7	Indirect tests of milk for the detection of mastitis 1	
Total		15

REFERENCES

Chakravarti, A 2011. Text Book of Clinical Veterinary Medicine. Kalyani Publishesrs , India

Chakravarti, A. 2011. Text Book of Preventive Veterinary Medicine. Kalyani Publishers, India

Merc. Veterinary Manual, 2010. Merc and CO, USA (10th Edition)

AQUACULTURE

Course Code : AQU 201

Course Title : Principles of Aquaculture

Credit Hours : 2 (1+1)

Full Marks: 50

Theory: 25

Practical: 25

OBJECTIVES

Upon the completion of the course, the students will be able to explain the characteristics of cultivable and cultivated fish species, and their management practices.

I. SYLLABUS

Definition and biological characteristics; water quality management; pond management; fish farming systems; fish breeding, nursing and rearing; common fish diseases and parasites.

II. COURSE OUTLINE

A. Theory

S.N.	Topic	No of Lectures
1.	Introduction: Definition of fish, fishery and aquaculture, General characteristics of fish, desirable characters of fish for culture, Importance of fish.	1
3.	Biology of cultivated fish species: Morphological characters, feeding habits, growth rate and reproductive behavior of Common carp, Chinese carps, Indigenous major carps, Tilapia, Trout, Catfishes, Sahar, Silver barb and Freshwater prawn.	2
4.	Water quality management: Physical parameters–Temperature and Turbidity; Chemical parameters-DO and pH; Biological parameters- Plankton	2
5.	Pond management: Site selection for pond construction, Liming, fertilization, Feed and Feeding, Aquatic weeds and Predators contro	3
6.	Fish farming systems (FFS):Introduction; Classification of FFS on the basis of intensity, enclosure, fish species and integration	2
7.	Fish breeding: Basic principles of fish breeding; Breeding of common carp, Chinese carps and Indigenous major carps, Fish seed rearing and transportation	3
8.	Common fish diseases and parasites: Introduction, causal organisms, symptoms and control measures of Saprolegniasis, Tail rot/fin rot, White spot disease, Dactylogyrosis, Argulosis; and Asphyxiation	2
Total		15

B. Practical

S.N.	Topic	No of Practicals
1.	Visit of a fish farm	1
2.	Morphology of cultivated fishes of Nepal	1
3.	Anatomy of fish (internal organs - alimentary canal, gills, gonads)	1
4.	Pond types and measurements of a typical pond	1
5.	Pond liming and fertilization	1
6.	Water quality measurements (temperature, transparency, DO and pH)	1
7.	Feed formulation and Feeding	1
8.	Study of different fish farming system	1
9.	Common carp breeding	3
10.	Study of fishing gears and pond netting	1
11.	Examination of skin and gills	1
12.	Identification of common drugs and chemicals used in fish health management	1
13.	Lab wrap up	1
Total		15

REFERENCES

- Augusty, K.T. 1979. Fish Farming in Nepal. Archana Printers & Publishers, Kottayam 29, India.
- ICAR. 2006. Handbook of Fisheries and Aquaculture. Indian Council of Agricultural Research (ICAR), New Delhi.
- Jha, D.K. 1991. Laboratory Manual of Fish Disease. Tribhuvan University, IAAS, Rampur.
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- Shrestha T.K. and D.K. Jha. 1993. Introduction to Fish Culture. Institute of Agriculture and Animal Science, Rampur, Chitwan, Nepal.
- Woyrnarovich, E. and L. Horvath. 1984. The Artificial Propagation of Warm Water Finfishes, A Manual for Extension.

ENTOMOLOGY

Course Code : ENT 201

Course Title : Introductory 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 Lecture
1	Introduction	
1.1	Introduction–definition, scope and importance of insects and entomology, disciplines of entomology	1
1.2	Specialties of insects and the causes of success of insects over other creatures	1
1.3	Origin, evolution and position of insects in animal kingdom	1
1.4	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 (compound and simple eyes)	1
2.6	Thorax: Segmentation, structure, legs and their modifications, wing venation, wings and their modifications	1

3.	Basic life processes and their physiology	
3.1	Internal anatomy and physiology of feeding, digestion and excretion	1
3.2	Internal anatomy and physiology of respiration and circulation	1
3.3	Basics on sense organs, nervous system and nerve impulse transmission	1
3.4	Bioluminescence and sound production in insects	1
3.5	Introduction to life cycles and life-history	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	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, Hemiptera (Heteroptera) and Homoptera	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 and preservation of insects	1
5.	Miscellaneous aspects of entomology	
5.1	Sprayers: their parts and calibration; and calculation of pesticides	1
5.2	Introduction to industrial insects: honey bees, silkworms and lac insects	1
5.3	Introduction to veterinary insects	1
5.4	Insects of public health importance	1
5.5	Insects with forensic and nutritional importance	1
5.6	Recent advances, innovations and implications of entomology	1
Total		30

B. Practical

S.N.	Topic	No. of Practical
1.	Study of microscope	1
2.	Collection and preservation of insects	1
3.	External morphology of an insect	1
4.	Insect mouth parts of cockroach/grasshopper and plant bugs	1
5.	Insect mouth parts of butterflies/moths and honey bees	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.	Life-cycle of honeybee, silkworms and lac insects	1
11.	Types of larvae and pupae	1
12.	Identification of important apterygote insects	1
13.	Identification of economically important exopterygote insects	1
14.	Identification of economically endopterygote insects	1
15.	Sprayers and their calibration	1
Total		15

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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.

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Course Code : ENT 202

Course Title : Principles and Practices of Insect Pest 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 the basic principles and practices of integrated pest management including various approaches of pest management.

I. SYLLABUS

Introduction, principles and methods, economic decision level, pesticide residue analysis, components, IPM-FFS, pest and natural enemies (NEs), pesticide and their managements, host plant resistant, biological control, novel pest management practices etc.

II. COURSE OUTLINE

A. Lecture

S.N.	Topics	No. of Lectures
1.	Crop pest and pest management	3
1.1	Pest: Concept of pest, Classifications of insect on different basis, General impact of pest, Common agricultural pest Pest Management: Concept of management, Terminology related to IPM, Insect pest management, Integrated pest management, Organic pest management. History; Historical aspect of crop protection, Historical aspect of integrated pest management in world, Developmental history of IPM in Nepal	
2.	Basic concept of IPM tactics and strategies	2
2.1	IPM Tactics: Pest manipulation, Plant manipulation, Environment manipulation	
2.2	Basic strategies of IPM	
3.	Concept of decision level and significance for threshold level assessment	3
3.1	Decision level assessment tools: Monitoring, Survey and Surveillance	
3.2	Concept of threshold level for assessment of decision level of pest management	
3.3	Significance of decision level in pest management	

4.	Basic concept of IPM tactics and strategies	
4.1	Cultural method: Principle and common practices of cultural methods and Significance in pest management	2
4.2	Mechanical methods: Principle and practices of mechanical pest of pest management and Significance in pest management	2
4.3	Physical methods: Principle and practice of physical methods of pest management and Significance in pest management	2
4.4	Legislative pproaches: Basic concept of legislative approaches through quarantine, Quarantine of Nepal and their role in pest management, Pest risk analysis and its significance in pest management, National and International IPM policies	4
4.5	Biological method of pest management: Concept, type of biological organisms and short history of biological control in pest management, Type of bio-pesticides and their role in pest management	2
4.6	Host plant resistance (HPR): Basic concept, history and significance in pest management, Mechanisms and measurement techniques of HPR, Genetic engineering techniques and their significance in IPM	3
4.7	Chemical pest management: Type, classification, formulation, hazardous level and international convention related to pesticide, Pesticide appliance, spray techniques, exposure of pesticide, residue levels and residue level measurement, Pollution caused by pesticides, areas of misuse, and precautionary measurements	3
5.	Innovative control methods and their use in IPM	1
6.	Common IPM tools available in Nepal and their possible Integration in pest management	1
7.	Concept of IPM Extension model through Farmers Field School.	1
8.	Possible Market management strategy of IPM product	1
Total		30

B. Practical

S.No.	Topics	No. of Practical
1.	Familiarization of IPM tools available in Entomology Lab.	1
2.	Identification of common predators and parasitoids available in Ento. Lab	1
3.	Regular monitoring of common pest through pheromone traps	1
4.	Monitoring of Fruit fly through cure lure trap	1
5.	Preparation of botanical bio-pesticide and their spray techniques	1
6.	Chemical pesticide formulation and spray techniques in the field	1
7.	Identification and collection of insect repelling botanical materials available in university periphery	1
8.	Collection and identification of insect pests, diseases, weeds and natural enemies (NEs) of different crops	1
9.	Pesticide survey in market and their classification: A case study	1
10	Assessment of morphological resistant characteristics of certain crop against insect pest	1
11.	Bioassay techniques of pesticide and bio-pesticide against common pest	1
12.	Introduction of Bio-pesticide available in the market and familiarization of production techniques of Heli-NPV.	
13.	Rearing of <i>Corcyra</i> for <i>Trichogramma</i> production and releasing techniques in the maize field.	1
14.	Insect zoo and cup study and its significance	1
15.	Isolation of EPF from soil and lab study of bio-pesticide focused on <i>Metarhizium</i>	1
Total		15

REFERENCES

Dhaliwal, G.S. and R. Arora. 2001. Integrated Pest Management- Concepts and Approaches. Kalyani Publishers, New Delhi, India.

FAO. 2000. Cabbage Integrated Pest Management: An Ecological Guide. FAO Inter-Country Program for the development and application of integrated pest management in vegetable growing in South and Southeast Asia 125p.

Neupane, F.P. 2002. Tarkari Balima Lagne Kiraharuko Akikrit Bebastaphan (in Nepali) (Integrated Management of Vegetable Insects, translated in English. Jagadamba Press, Patandhoka, Lalitpur, Nepal. 172p.

Norris. R.F. and E.P.C-Chen and M. Kogan. 2002. Concepts in Integrated Pest Management. Prentice-Hall of India Pvt. Ltd. New Delhi India. 586p.

Course Code : ENT 303

Course Title : Economic 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 know common insect pests of crops, their identification and management practices using novel techniques.

I. SYLLABUS

Systematic position, distribution, host identification, nature and extent of damage, life cycle, and seasonal histories, and control measures of important insect and non-insect pests (rodents birds, mites, wild animals and others) of cereals, pulses, oilseeds, vegetables, fruits, industrial crops, spices and condiments grown in Nepal. Storage grain pests and their control. Management of vector borne, polyphagous, soil hibernating and resistant insect pests.

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lectures
1.	Systematic position, distribution, host identification, nature and extent of damage, life cycle and seasonal histories of harmful insect pests associated with different crops.	4
2.	Insect pests of cereal crops and their management	1
3.	Insect pests of pulse crops and their management	1
4.	Insect pests of oilseed crops and their management	1
5.	Insect pests of vegetable crops and their management	5
6.	Insect pests of fruit crops and their management	5
7.	Insect pests of industrial crops, spices & condiments and their management	5
8.	Insect pests of storage grains and their management	2
9.	Management of disease vectors, polyphagous and soil hibernating insect pests	3
10.	Vertebrate pests and their management	1
11.	Pest resistance, pesticide residues and health problems	2
Total		30

B. Practical

S.N.	Topic	No. of Practical
1.	Periodic visits to farms for crop pests monitoring	1
2.	Farm visit for collection and identification of predators	1
3.	Farm visit for collection and identification of parasitoids	1
4.	Farm visit for collection and identification of crop pollinators	1
5.	Collection and identification of major insect pests of rice and maize	1
6.	Collection and identification of major insect pests of wheat and millets	1
7.	Collection and identification of major insect pests of pulse crops	1
8.	Collection and identification of major insect pests of oilseed crops	1
9.	Collection and identification of major insect pests of fruit crops	1
10.	Collection and identification of major insect pests of industrial crops	1
11.	Collection and identification of major insect pests of stored grains	1
12.	Collection and identification of major virus vector insect pests	1
13.	Collection and identification of major vertebrate pests	1
14.	Collection and identification of medical and veterinary importance	1
15.	Identification and management of rodents	1
Total		15

REFERENCES

Atwal, A.S. 1993. Agricultural Pests of India and South-East Asia. Kalyani Publishers, New Delhi.

Neupane, F.P. 2000. Bali Biruwa Ka Satruharu Ra Tinka Roktham (in Nepali). 4th edition. Sajha Prakasan.

Panwar, V.P.S. 1995. Agricultural Insect Pests of Crops and their Control. Kalyani Publishers, New Delhi.

Course Code : ENT 304

Course Title : Industrial Entomology

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

OBJECTIVES

Upon the completion of this course, the students will have clear concepts of beneficial insects such as honey bees, silkworms, lac insects and biological agents and crop pollinators.

I. SYLLABUS

Beneficial insects of food, medicine and aesthetic values, commercialization of honey bees, silkworms, lac insects, biocontrol agents, crop pollinators and eco-environmental indicators

II. COURSE OUTLINE

A. Lecture

S.N.	Topics	No. of Lecture
1.	Introduction	
1.1	Introduction, significance, history and scope	1
1.2	Beneficial insects: their role in food, medicine, aesthetic values and as an environmental indicators	1
2.	Apiculture, sericulture and lac culture	
2.1	Apiculture: definition, history, scope and prospects	1
2.2	Major honey bee species: exotic and indigenous	1
2.3	Morphological specialties: mouth parts, legs and others	1
2.4	Honey bee castes, biology and behaviours	1
2.5	Bee keeping technology: artificial feeding and queen management	1
2.6	Honey bee problems: pests, diseases and pesticide poisoning	1
2.7	Sericulture: definition, history, scope and prospects	1
2.8	Silkworm rearing technology, harvesting and processing	1
2.9	Silkworm diseases and their management	1
2.10	Industrial aspects of lac insects	1
3.	Different aspects of industrial entomology	1
3.1	Prospects on biological control agents	1
3.2	Industrial aspects of crop pollinators	1
3.3	Prospects on scavengers and environmental indicators	1
Total		15

B. Practical

S.N.	Topics	No. of Practical
1.	Study of insect products	1
2.	Study of life cycles of honey bees	1
3.	Bee hives and tools/equipments used in beekeeping	1
4.	Preparation of artificial feeds for different seasons	1
5.	Queen preparation and technique of dequeening and requeening	1
6.	Bee colony transfer and live hive transportation	1
7.	Identification of bee flora: Nectar, pollen and propolis sources	1
8.	Honey harvesting, processing and storage	1
9.	Bee keeping records and inventory	1
10.	Silkworm life stages and feeding	1
11.	Humidity, temperature and diseases management in silkworm rearing	1
12.	Laboratory rearing techniques of bio-control agents: parasitoids	1
13.	Collection and identification of major pollinators	1
14.	Practical learning in scavengers	1
15.	Practical learning in environmental indicators	1
Total		15

REFERENCES

Dhaliwal, GS and Singh B. 2000. Pesticides and environment. Commonwealth Publishers, New Delhi, India

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Naim, M. 1993. Beekeeping: pleasure and profit. Kalyani Publisher, New Delhi, India

Pratap, U. 1997. 1997. Bee flora of Hindu Kush Himalayas: Inventory and management. ICIMOD, Kathmandu, Nepal

Shukla, A. N. 2000. Beekeeping Trainers Resource Book (in Nepali), ICIMOD, Kathmandu, Nepal.

ENVIRONMENTAL SCIENCE

Course Code : BCH 101

Course Title : General Biochemistry

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

OBJECTIVES

Upon the completion of this course, the students will be able to understand the structure and functions of sugars, lipids, proteins, nucleic acids and metabolism of biomolecules

I. SYLLABUS

Introduction, concepts, importance, pH, buffer major biomolecules classification and functions, structures, Central metabolic pathways, Biosynthesis and degradation of biomolecules

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lecture
1	Introduction	
1.1	Concepts, scope, and importance of biochemistry	1
1.2	Structure of water, its properties, and importance as a biological solvent	1
1.3	pH: Henderson_Hassalbalch equations and its application; Buffer: definition, biological buffer with special refrence to phosphate buffer	1
2	Classification and function of major biomolecules	
2.1	Definitions, classification and functions of carbohydrates	1
2.2	Definition, functions and classification of standard amino acids	1
2.3	Definition, function and classification of lipids and proteins	1
3	Structure of Carbohydrates	
3.1	Structure of glucose, fructose, sucrose and lactose	1
3.2	Structure of Cellulose, hemicellulose, pectin, chitin, Glycogen and starch	1
4	Structure of amino acids and protiens	
4.1	Structure of standard amino acids	1
4.2	Structure of Proteins	1
5	Structure of Lipids	
5.1	Structure of common fatty acids that occur in lipids	1
5.2	Structure of Acyl glycerol	1
5.3	Structure of phospholipid, glycolipids and sphingolipids,	1
5.4	Structure of soluble vitamins, essential oils and terpenoids	1

6	Structure and functions of nucleic acid	
6.1	Structure and function of nucleotides and DNA	1
6.2	Structure and function of different RNAs	1
7	Enzymes	
7.1	Introduction, nomenclature, classification, and function of enzymes	1
7.2	Properties of enzymes, mechanism of enzyme action	1
7.3	Co-enzymes and enzyme inhibition	1
8	Central metabolic pathways	
8.1	Calvin-Benson cycle	1
8.2	Glycolysis	1
8.3	Kreb's cycle, ETS	1
9	Biosynthesis of biomolecules	
9.1	Biosynthesis of sucrose and starch	1
9.2	Biosynthesis of fatty acids and triacylglycerols	1
9.3	Biosynthesis of fatty acids and amino acids	1
9.4	Biosynthesis of proteins	1
10	Degradation of biomolecules	
10.1	Degradation of sucrose and starch	1
10.2	Degradation of glycogen, triacyl-glycerols and proteins	1
10.3	Degradation of amino acids and fatty acids (Beta- Oxidation pathway)	1
Total		30

B.Practical

S.No.	Topic	No. of Practical
1	Preparation of standard solution	1
2	Preparation of buffers solution	1
3	Preparation of colloidal solution	1
4	Qualitative tests on carbohydrates	1
5	Qualitative tests on lipids	1
6	Qualitative tests on amino acids and proteins	1
7	Quantitative estimation of reducing sugars	1
8	Quantitative estimation of amino acids	1
9	Quantitative estimation of proteins	1
10	Enzymatic action of potato oxidase or urease or catalase	1
11	Demonstration of Differential centrifugation	1
12	Demonstration of Polyacrylamide gel electrophoresis	1
13	Demonstration of Paper chromatography	1
14	Demonstration of Thin-layer chromatography	1
15	Demonstration of Spectrophotometry or colorimetry	1
Total		15

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- 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. Brueing and H. D. Roy. 1987 Outlines of Biochemistry. JohnWiely & Sons , New York.

Course Code : PPH 101

Course Title : Introductory 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.

I. SYLLABUS

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

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lecture
1	Introduction	
	Definition, scope and practical applications of crop physiology	1
2	Cell physiology	
2.1	Definition, types and ultra structure of typical cell	1
2.2	Structure and functions of cell organelles: mitochondria, chloroplast, endoplasmic reticulum, nucleus, ribosome, microbodies, and cytoskeleton	1
3	Biophysio-chemical phenomenon	
3.1	Laws of thermodynamics	1
3.2	Diffusion and osmosis	1
3.3	Concept of water potential	1
4	Absorption and translocation of water and minerals	
4.1	Absorption of water and ascent of sap: concepts, mechanism and factors affecting water absorption and ascent of sap	1
4.2	Mineral absorption and translocation: site and mechanism (passive and active uptake) of mineral uptake and factors affecting mineral translocation,	1
4.3	Metabolic utilization of mineral ions and their deficiency symptoms	1
4.4	Transpiration: concepts, importance, types, mechanism of stomatal movement, and	1
4.5	Factors affecting transpiration and Guttation	1

5	Photosynthesis	
5.1	Concepts, significance, absorption spectra, photosynthetic pigments, light reaction of photosynthesis (pigment system I and II, cyclic and non-cyclic photophosphorylation)	1
5.2	Dark reaction: C ₃ cycle, C ₄ cycle, and distinction between C ₃ and C ₄ plants,	1
5.3	Crassulacean acid metabolism, and photorespiration	1
5.4	Factors affecting rate of photosynthesis	1
6	Respiration	
6.1	Concepts, types, and significance of respiration, respiratory quotient and energy balance in calories	1
6.2	Mechanism of photometer : Glycolysis and oxidation of pyruvic acid,	1
6.3	Kreb's cycle and its importance, Electron transport system and oxidative phosphorylation with inhibitory compounds	1
6.4	Factors affecting the rate of respiration	1
7	Translocation of organic solutes	
7.1	Concept, phloem anatomy, apoplstic and symplastic transport, phloem loading and unloading	1
7.2	Transport mechanisms: protoplasmic streaming hypothesis, contractile protein hypothesis, mass flow hypothesis. Source sink concept and translocation of solutes	1
8	Growth and development	
8.1	Definition, phases and course of growth and development	1
8.2	Seed germination: concepts, metabolic changes during germination, factors affecting germination	1
8.3	Seed dormancy: concepts of primary and secondary dormancy, causes of dormancy, breaking of dormancy	1
8.4	Photoperiodism: concepts, plant types based on photoperiodic response, mechanisms of photoperiodism in reproduction physiology	1
8.5	Vernalization: concepts and site of vernalization, and physiological and biochemical changes during vernalization	1
9	Plant growth regulators	
9.1	Definitions, classification, synthesis of Auxin, Gibberellins, Cytokinin, Ethylene, Abscisic acid.	1
9.2	Role of growth regulators in agriculture	1
10	Yield attributing characteristics of crops	1
10.1	Photosynthesis, respiration, leaf canopy, source and sink, crop species and growth analysis	1
<hr/> Total		30
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B. Practical

S.N.	Topic	No. of Practical
1.	Isolation of cell organelles by centrifugal process	1
2.	Determination of DPD of potato tubers by gravimetric methods/ plasmolytic methods.	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.	Study the field symptoms of certain essential micro and macro-mineral elements in crop plants	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.	Field visit for physiological in crop plants	1
15.	Field visit to different crop field for studying physiological aspect.	1
Total		15

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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 : MIB 201

Course Title : Agricultural Microbiology

Course Hour : 2 (2+0)

Full Marks: 50

Theory: 50

Practical: 00

OBJECTIVES

Upon the completion of this course is that the student will able to understand the fundamentals of agri microbiology; role of microbes to increase productivity, and soil fertility.

I.SYLLABUS:

Introduction to microorganism, their distribution, historical background and its importance in Agriculture. Prokaryotic and Eukaryotic microorganisms, their cell structure and functions, Nutritional requirement and Genetics of Bacteria; Role of microorganisms in soil fertility and crop production, carbon, nitrogen and sulphur transformation. Plant microbes association: symbiotic, associative and non symbiotic nitrogen fixation, Azolla, blue, green algae and mycorrhiza; Plant Microbes Interaction: the rizosphere and phyllosphere effect and microbes; Microbial degradation of cellulose, starch, lipids, lignin, pectin and proteins present in organic residues. Introduction to Plant pathogenic microorganisms. Microbiology of milk and dairy products. Microbial Contamination of foods, food borne infection and toxins; Introduction to Sewage microbiology and role of microbes in Silage production, microbes for Bioassay and biological Warfare. Microorganisms in Economic use; (e.g. Food from microbes, microbes in retting of fibers, medicines, antibiotics, curing of tobacco and tea. Biopesticides and biofertilizer.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lecture
1.	Introduction to microorganisms, their distribution,	1
2.	Historical background and their importance in agriculture.	1
3.	Prokaryotic and eukaryotic microorganisms;	1
4.	The cell structure of Prokaryotic and eukaryotic microorganisms	1
5.	The functions of Prokaryotic and eukaryotic microorganisms	1
6.	Nutritional requirements of bacteria	1
7.	Genetics of bacteria	1
8.	Role of Microorganisms in soil fertility and crop production:	1
9.	Carbon and nitrogen transformation	1
10.	Sulfur transformation	1
11.	Symbiotic Plant- microbes association	1
12.	Plant- microbes association;, associative nitrogen fixation	1
13.	Plant- microbes association; non symbiotic nitrogen fixation	1
14.	Plant microbes interaction ; microbes effect	1

15.	Plant microbes interaction ; the Rhizosphere and Phyllosphere effect	1
16.	Microbial degradation of cellulose and starch in organic residues	1
17.	Microbial degradation of lipids and proteins present in organic residues	1
18.	Microbial degradation of lignin and pectin present in organic residues	1
19.	Introduction to plant pathogenic microorganisms	1
20.	Biodegradation of the agricultural chemicals	1
21.	Microbiology of milk	1
22.	Microbiology of milk products	1
23.	Microbial Contamination of foods, food borne infection and toxins	1
24.	Food borne infection and toxins	1
25.	Introduction to Sewage microbiology	1
26.	Introduction to Microorganism Bioassay and biological Warfare	1
27.	Introduction to Silage production	1
28.	Economics in food, fermentation	1
29.	Economics in medicine, antibiotic curing of tobacco and tea	1
30.	Economics in biopesticide and biofertilizers	1
Total		30

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Collins, C. H., P. M. Lyrie and J. M. Crang. 1989. Micro-biological methods. Academic Press, New York.

Kamal, Pande, Rao. 2001. Introductory Microbiology and Plant Pathology (2nd ed.) Students-Friends Publishers. Allahabad.

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Pelczar, M. J., E. C. S. Chan and N. R. Kreig. 1993. Microbiology (5th ed.) McGraw-Hill Publishing Co. New Delhi.

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Rangaswami, G. and Bagyaraj, D. J. 1992. Agricultural Microbiology. Asia Publishing House, New Delhi.

Course Code : ECO 201

Course Title : Environmental Science and Agroecology

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

OBJECTIVES

Upon the completion of this course, the students will know the concept of environmental Science and Agroecology, EIA and its method, climate change and its impact in agro-ecology.

I.SYLLABUS

Introduction to environmental science and agro-ecology, environmental issues, conservation and management strategies and recent advances, farm house ecology, ecological principles and agro-ecosystem dynamics, agro-ecosystem ecology, environmental impacts on agriculture, EIA, Global warming and climate changes, agro-ecology of production systems and sustainability of agro-ecosystem.

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lectures
1	Introduction to environmental science and agroecology	2
	1.1 Concepts, fields, and scope of environmental science and agroecology with particular reference to Nepal	
	1.2 Interrelationships between human population and the environment	
2	Environmental issues	4
	2.1 Environmental issues: population, deforestation, urbanization, waste disposal, pesticide uses and abuse	
	2.2 Types and sources of pollutants (air, soil and water)	
	2.3 Their impacts on natural ecosystems.	
	2.4 Their impact on agricultural ecosystems.	
3	Conservation and management Strategies and recent advances	5
	3.1 Different organization involved in agroecology and different strategies used by our country	
	3.2 Effect of Climate change in agroecology	
	3.3 Different adaption procedure in crop field	
	3.4 Government policy and people's participation in law and programs in environmental management	
	3.5 Education, research and development in environmental science and agroecology	

4	Farmhouse ecology and ecological principles and agroecosystem dynamics	2
4.1	Understanding and analysis of environmental components of farm house/ home garden, interlinkages of and agroecosystem (farm, crop, farmers, etc)	
4.2	Component agroecosystem, their linkages, Energy flow, ecological pyramids, food chains, food webs and trophic level.	
5	Agroecosystem ecology	2
5.1	Interaction of crop with weeds, pest, pathogens and their interaction	
5.2	Different management strategies in crop field	
6	Environmental impacts on agriculture	3
6.1	Ecological degradation due to chemical agriculture, deforestation and soil erosion	
6.2	Declining soil fertility, soil productivity and farm profitability and reduction in biodiversity	
6.3	Food quality degradation, water bodies contamination, Biomagnification and health hazard	
7.	Environmental Impact Assessment	3
7.1	Definition of EIA, IEE, need of EIA and IEE and legal provision of EIA and IEE	
7.2	Different types of environmental impacts and impact identification	
7.3	Procedure for EIA and IEE	
8	Global warming and climate change	3
8.1	Green house effect, global warming and climate change	
8.2	Source and sink of green house gases	
8.3	Impacts of climate change on snow melting, sea level rise, and agriculture and economy of Nepal.	
9	Agro-ecology of production system	4
9.1	Agro-ecology of shifting cultivation, multiple cropping, crop rotation, cover cropping, agroforestry system	
9.2	Definition, advantage and limitation for sustainable agriculture	
9.3	Conservation agriculture and principles of CA and Organic farming	
9.4	Ecological aspects of CA and SALT	
10	Sustainability of Agro-ecosystem	2
10.1	Properties of Agro-ecosystem: Productivity, stability, equitability and sustainability	
10.2	Challenges, strategies and requirement of sustainable agriculture	
<hr/> Total		30
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Altieri, M. A. 1987. Agro-ecology. The Scientific Basis of Alternative Agriculture. Division of Biological Control. University of California.

Conway G. R. 1986. Agro-ecosystem Analysis for Research and Development. Bangkok Winrock International Institute for Agriculture Development.

Shimpei Murakami. 1991. Lessons from Nature. A Guide to Ecological Agriculture in the Tropics. NongJok Natural Farming Center. Bangkok. Thailand.

R. B. Khadka, Ron Bisset and Peter A. Neame. 1996. EIA Training Manual for Professional and Managers. IUCN Publication.

Course Code : ECO 302
Course Title : Medicinal and Aromatic Plants
Credit Hours : 2(1+1) Full Marks: 50 Theory: 25 Practical: 25

OBJECTIVES

Upon the completion of this course, the students will be able to understand the importance of medicinal and aromatic plants (MAPs), its traditional uses and research status of MAPs.

I. SYLLABUS

Introduction, history, classification, importance, prospects and constraints of medicinal and aromatic plants, research status of MAPs in Nepal, extraction and storage methods for MAPs, impacts of environmental degradation, climate change and over exploitation on MAPs, phytomedicine and uses of MAPs in different traditional health care system and description, origin, distribution and chemical evaluation of Medicinal and Aromatic Plants.

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lectures
1	Introduction, history, classification of Medicinal and Aromatic Plants	1
2	Importance, prospects and constraints of medicinal and aromatic plants	1
3	Classification of Medicinal and Aromatic Plants	1
4	Extraction and storage methods for Medicinal Plants	1
5	Status of Environmental degradation and Climate Change in Nepal	1
6	Effect of Climate change and environment degradation in MAPs	1
7	Way to reduce effect of climate change and over exploitation of MAPs	1
8	Phytomedicines and Medicinal crops. Uses of Medicinal plants in Aurveda,	1
9	Uses of Medicinal plants in Siddha, Yoga, Unani, Naturopathy, Homeopathy, Chinese Medicine,	1
10	Uses of Medicinal plants in Folk-remedies and other traditional health care system	2
11	Description, origin, distribution and chemical evaluation of	
	A) Medicinal plants: Aloe, Datura	1
	B) Medicinal plants: Rauwolfia, Neem	1
	C) Aromatic plants: Ginger grass, Mint,	1
	D) Aromatic plants: Rose, Tulsi	1
ToTal		15

B. Practical

S.N.	Topic	No. of Practical
1.	Preparation of questionnaire designed for recording traditional uses of locally available herbs/ MAPs.	1
2.	Pre-testing of questionnaire designed for recording traditional uses of locally available herbs/MAPs.	1
3.	Documentation of local uses of important medicinal plants of local tribal community tharu	1
4.	Documentation of local uses of important medicinal plants of local tribal community darai	1
5.	Documentation of local uses of important medicinal plants local tribal community bote	1
6.	Documentation of local uses of important medicinal plants local tribal community chepang	1
7.	Identification of important high value herbs and their products	1
8.	Identification of important aromatic plants and their products	1
9.	Nursery bed preparation	1
10.	Planting of medicinal plants.	1
11.	Planting of aromatic plants.	1
12.	Field observation of herbal farms (medicinal plants)	1
13.	Field observation of herbal farms (aromatic plants)	
14.	Field observation of processing plants (medicinal plants)	1
15.	Field observation of processing plants (aromatic plants)	1
Total		15

REFERENCES

- Atal, C. K. and B. M. Kapur (Eds.). 1982. Cultivation and Utilization of Medicinal and Aromatic Plants. Regional Research Laboratory, CSIR, Jammu-Tawi, India.
- Bhattacharjee, S. K. 2000. Hand Book of Aromatic Plants. Pointer Publisher, Jaipur, India.
- Hussain, A. 1992. A status report on Cultivation of Medicinal Plants in NAM countries. Center of Science and Technology of the Non-aligned and other Developing Countries, New Delhi.
- IUCN Nepal. 2000. National Register of Medicinal Plants. IUCN-Nepal, Kathmandu.
- Kaufman, P. B., L. J. Cseke, S. Warber, J. A. Duke, and H. L. Brielmann. 1999. Natural Products from Plants. CRC Press, UAS. Journal of Medicinal and Aromatic Plants

Course Code : ECO 403

Course Title : Agro-biodiversity Conservation and Climate Change

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

OBJECTIVES

Upon the completion of this course, the students will be able to understand agrobiodiversity conservation and climate change in the local, regional, and worldwide perspectives.

I. SYLLABUS

Introduction to agricultural biodiversity: Concepts, history, importance and prospects; centers of origins of crops and animal diversity, Components of Agricultural biodiversity, Status of Agricultural biodiversity, Threats to agricultural biodiversity: documenting and assessing, Conservation of Agricultural Biodiversity, Policies and Laws for Agrobiodiversity conservation, Economic value of Agrobiodiversity, Social and ethnical aspects in agrobiodiversity, Different on-farm conservation and management practices in Nepal, Forest and agrobiodiversity, Introduction to Climate change and its historical overview, Earth's climate system, Interpreting past climate from geologic records and its effect on agrobiodiversity, Long-term climate change related to plate tectonics, the last ice age and last deglaciation, history of climate change, orbital control on monsoons and ice sheets, instrumental period of Climate Change, agrobiodiversity and climate change, food security and climate change, Climate Change Adaptation, climate change resilience, different institutional mechanism in Agrobiodiversity conservation, different institutional mechanism in Climate Change, climate induced disasters, Intellectual Property Rights, Farmers' Rights, local innovation and practices on Agrobiodiversity conservation, local innovation and practices on Climate change adaptation, Research trends on agrobiodiversity conservation and climate change

II. COURSE OUTLINES

A. Lecture

S.N.	Topic	No. of Lecture
1.	Introduction to agricultural biodiversity: Concepts, history, importance and prospects; centres of origins of crops and animal diversity	1
2.	Components of Agricultural biodiversity	1
3.	Status of Agricultural biodiversity	1
4.	Threats to agricultural biodiversity: documenting and assessing	1
5.	Conservation of Agricultural Biodiversity	1
6.	Policies and Laws for Agrobiodiversity conservation	1
7.	Economic value of Agrobiodiversity	1
8.	Social and ethnical aspects in agrobiodiversity	1

9.	Different on-farm conservation and management practices in Nepal	1
10.	Forest and agrobiodiversity	1
11.	Introduction to Climate change and its historical overview	1
12.	Earth's climate system	1
13.	Interpreting past climate from geologic records and its effect on agrobiodiversity	1
14.	Long-term climate change related to plate tectonics	1
15.	The last ice age and last deglaciation	1
16.	History of climate change	1
17.	Orbital control on monsoons and ice sheets	1
18.	Instrumental period of Climate Change	1
19.	Agrobiodiversity and climate change	1
20.	Food security and climate change	1
21.	Climate Change Adaptation	1
22.	Climate change resilience	1
23.	Different institutional mechanism in Agrobiodiversity conservation	1
24.	Different institutional mechanism in Climate Change	1
25.	Climate induced disasters	1
26.	Intellectual Property Rights	1
27.	Farmers' Rights	1
28.	Local innovation and practices on Agrobiodiversity conservation	1
29.	Local innovation and practices on Climate change adaptation	1
30.	Research trends on agrobiodiversity conservation and climate change	1
Total		30

REFERENCES

- Hardy, J. T., 2003. Climate Change - Causes, Effects, and Solutions, 1st Edition, John Wiley & Sons
- T. Houghton 2004. Global Warming - (3rd edition) Cambridge University Press.
- Keith, A. (ed), 2005. Global Change and the earth system, Springer, Publication Ltd, London.
- Altieri, M.A. 1987. Agro-Eology. The Scientific Basis of Alternative Agriculture, Westview Press Colorado, USA.
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- ABPSD. 2006. Statistical Information of Nepalese Agriculture, MOAC, Agri-Business Promotion and Statistic Division, Kathmandu, Nepal.
- Jodha N, S. Baskota and U. Pratap. 1992. Sustainable Mountain Agriculture (Vol. 1 and 2), ICIMOD, Kathmandu, Nepal.
- Ya Tang and P.M. Tulachan. 2001. Mountain Agriculture in the HK-regions ICIMOD, Kathmandu, Nepal.

HORTICULTURE

Course Code : HRT 101

Course Title : Introductory Horticulture

Credit Hours : 3(2+1)

Full Marks: 75

Theory: 50

Practical: 25

OBJECTIVES

Upon the completion of this course, the students will get basic knowledge and skills on general horticulture in Nepalese prospectives.

I. SYLLABUS

Meaning, branches and relation of horticulture with other discipline, classification of horticulture plants, status of horticulture development in Nepal, factors affecting horticulture crop production and measures to overcome them, general introduction to various types of horticulture enterprises, orchard establishment and management, basics of plant propagation and various methods, growth and development of horticultural plants, major classes of plant growth regulator and their use, basic principles and applications of training and pruning, basic principles of off- season and protected horticulture, organic horticulture crop production in Nepal, basic principles of high density planting, multi- storied cropping and multiple cropping with horticultural crops, indigenous horticulture plants in Nepal, principle of urban and periurban horticulture, verticulture, hydroponics and aeroponics and riverbed farming.

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lectures
1.	Meaning of horticulture, its branches and its relation with other disciplines	1
2.	Importance, scope, present status, national policy and plan for horticultural development in Nepal along with major constraints	1
3.	Classification of horticultural crops	2
	3.1 Botanical based classification of horticultural crops	
	3.2 Horticultural based classification of horticultural crops	
4.		2
	4.2 Agro-ecological zoning and niches from horticultural prospective	
	4.2 Economic significance of Agro ecological zoning of Nepal	
5.	Factors affecting horticultural crop production;	1
	5.1 Various environmental stress (moisture, temperature, light, flood and salt)	
	5.2 Measures to overcome them	
6.	General introduction to types of horticultural enterprises (Orcharding, nursery raising, ornamental gardening, vegetable farming and postharvest handling & preservation)	1

7.	Orchard establishment and management:	1
7.1	Site selection and layout of orchard	
7.2	Planting, soil and water management, wind break and shelter belts	
7.3	Manuring and fertilization, weed management, maintenance and care.	
8.	Basics of plant propagation	1
8.1	Introduction of plant propagation, sexual method	
8.2	Asexual method	
8.2.1	Cutting and layering	
8.2.2	Budding and grafting	
8.2.3	Specialized vegetative parts, micro and mist propagation	
9.	Growth and development:	
9.1	Concept of growth and development, dormancy	
9.2	Germination and juvenility	
9.3	Flowering, fruit set, fruit growth and development	
9.4	Maturity, unfruitfulness and fruit drops	
9.5	Ripening, tuber, rhizome and bulb development; senescence.	1
10.	Plant growth regulators	
10.1	Major classes of plant growth substances (auxin, gibberellins, cytokinins, ethylene and inhibitors) and their functions	
10.2	Commercial uses of PGR in Horticulture	1
11.	Training and pruning:	
11.1	Basic principles and objectives of training and pruning	
11.2	Various system/methods employed and their special application	1
12.	Basic principles and techniques of off season and protected horticulture and their prospects in Nepal	1
13.	Importance and prospects of organic horticulture crop production in Nepal	1
14.	Basic principles of high density planting, multi-storied cropping and multiple cropping with horticultural crops	1
15.	Importance and prospects of indigenous horticultural plants and their significance in nutritional and food security in Nepal	1
16.	Principles of urban and periurban horticulture; verticulture, hydroponics and aeroponics and river bed farming.	1
Total		30

B. Practical

S.N.	Topics	No. of Praticals
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 equipments; 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 hort. plants: Cutting Layering Grafting Budding Seeding	5
7.	Training practice in seasonal hort. plants	1
8.	Pruning practice in different methods	1
9.	Preparation and application of Bordeaux formulation	1
10.	Project developed on horticultural enterprises	1
11.	Visit to Horticultural farm at local level.	1
Total		15

REFERENCES

Shrestha, G.K.; Shakya, S.M.; Baral, D.R. and Gautam, D.M. 2001 (IInd Edition) Fundamentals of Horticulture, Inst. Agri. & An. Sci, Rampur, Chitwan, Nepal.

Shrestha, G.K.; Shakya, S.M.; Baral, D.R.; and Gautam, D.M. 1993. Laboratory Manual on Fundamentals of Horticulture, IAAS, Rampur.

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Prasad, S. 1997. Agros. Dictionary of Horticulture Agro-Botany, Bikaner, UP, India.

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Course Code : HRT 102

Course Title : Ornamental Horticulture

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 Ornamental Horticulture situation and basic knowledge and skills on landscape gardening, cultivation practices and propagation of ornamental plants.

I. SYLLABUS

Importance and history of Ornamental Horticulture, status, prospect and constraints of ornamental horticulture industry in Nepal, classification of ornamental plants, definition, history, scope, features and components of landscape gardening, factors affecting, elements, styles, steps and principles of landscape gardening design, use of plants in landscape design, lawn and its management, flower arrangement and its types, bonsai and its management, exhibition and judging of ornamental plants, flowers and potted plants, establishment of nursery enterprise, media, containers, equipment propagation and structure, cut flower and their cultivation, post harvest practices of cut and loose flowers, vase life study and vase solution, indoor gardening, pot culture display and hanging baskets, commercial cultivation of important cut flowers and loose flowers, protected cultivation of cut and loose flowers.

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lectures
1.	Importance and history of Ornamental Horticulture.	2
	1.1 Floriculture industry in Nepal, its status, prospects and constraints	
2.	Classification of Ornamental Plants	4
	2.1 Based on their aesthetic and functional value	
	2.1.1 Flowering plants	
	2.1.2 Ornamental foliage trees, Shrub and shrubberies	
	2.1.3 Climbers, Cactus and succulents, Bulbous plants	
	2.1.4 Based on their life cycle (Annual, biennial and perennial)	
3.	Landscape gardening	3
	3.1 Definition, history, scope, features and components of landscape gardening.	
	3.2 Factors affecting, elements, styles, steps of landscape gardening	
	3.3 Principle of landscape gardening design. Use of plants in landscape design	

4.	Lawn management	
4.1	Lawn and its preparation. Selection of grasses in different ecological zones, planting and sowing of seeds	2
4.2	Management of lawn grasses	
5.	Flower arrangements	2
5.1	Importance, styles (design), materials used in flower arrangements.	
5.2	Eastern and western type of flower arrangements.	
6.	Bonsai	2
6.1	Introduction and history of bonsai making, selection of plants	
6.2	Style and management of bonsai.	
7.	Exhibition and judging of ornamental plants, flowers (cut and loose) and potted plants.	1
8.	Establishment of nursery enterprises.	2
8.1	Nursery media, pot type or containers	
8.2	Equipments, propagation and structures.	
9.		4
9.1	Pre and postharvest practices of cut flowers and loose flowers.	
9.2	Vase life study and vase solutions.	
9.3	Indoor gardening, care and management	
9.4	Pot culture, display and hanging baskets.	
10.	Commercial cultivation of important cut flowers and loose flowers (Gladiolus, Rose, tuberose, Orchids, Carnation, Gerbera, marigold, Chrysanthemum, Bird of paradise, Anthurium)	6
10.1	Gladiolus	
10.2	Rose and tuberose	
10.3	Orchids and carnation	
10.4	Marigold and gomphrina	
10.5	Chrysanthemum and gerbera	
10.6	Bird of paradise and anthurium	
11.	Protected cultivation	2
11.1	Protected cultivation of cut flowers.	
11.2	Protected cultivation of loose flowers	
Total		30

B. Practical

S.N.	Topics	No. of Praticals
1.	Preparation of flower bed/seed bed/nursery bed	1
2.	Media preparation, potting and repotting of ornamental plants	1
3.	Preparation of lawn	1
4.	Preparation of bonsai	1
5.	Practices in different types of flower arrangement	1
6.	Cultivation practices of seasonal cut flowers	1
7.	Maintenance of indoor plants	1
8.	Practices in landscape gardening design	1
9.	Training practices of ornamental plants	1
10.	Pruning practice of ornamental plants	1
11.	Propagation practices in different types of ornamental plants	2
	11.1 Cutting and layering	
	11.2 Grafting and budding	
12.	Herbarium collection and identification of ornamental plants	1
13.	Project developed on floribusiness enterprises	1
14.	Nursery and flori farm visit at local level	1
Total		15

REFERENCES

Arora, J.S. 1990. Introductory Ornamental Horticulture.

Kalyani Publisher, New Delhi. Randhawa, G.S. and A. Mukhopadhyhy 1986. Floriculture in India. Allied Publisher, India.

Lauria, A. and H.R. Victor 2001. Floriculture: Fundamentals and Practices. Agrobios, India.

Bose, T.K. and L.P. Yadav 1989. Commercial Floriculture, Naya Prakash, Calcutta.

Course Code : HRT 203
Course Title : Fruit and Plantation Crop Production
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 manage the potential fruits and plantation crops growing in Nepal for commercial production.

I. SYLLABUS

Scope and importance of fruits and plantation crop production in Nepal. Classification of fruits based on climate requirement, pomology and growth habit etc. Identification of potential pocket area for commercial production of fruits and plantation crops. To have clear understanding about the origin, history, botany, uses, distribution, area, production, climate, soil, varieties, planting, propagation, training and pruning, growth behavior, flowering, fruit set, fruit drops, nutrition, manure and fertilizers, irrigation, intercropping, use of bio-regulators, disease and pest, physiological problems, harvesting, storage and marketing of banana, mango, papaya, pineapple, jackfruit, litchi, guava, citrus, pomegranate, apple, pear, peach, plum, walnut, apricot, kiwi, strawberry, grape, tea, coffee, cardamom and other indigenous, under exploited fruit crops and other nut crops.

II. COURSE OUTLINE

A. Lecture

S.N.	Topic	No. of Lectures
1.	Scope and importance of fruits and plantation crops in Nepal	1
2.	History and Government policy of fruit development in Nepal	1
3.	Potential pocket areas for commercial production of fruits and plantation crops.	1
4.	Cultivation practices of	27
	4.1 Tropical and subtropical fruits:	
	4.1.1 Banana	
	4.1.2 Mango	
	4.1.2.1 Physiological disorder, biennial bearing and disease and pest of mango	
	4.1.3 Papaya	
	4.1.4 Pineapple	
	4.1.5 Jack fruit	
	4.1.6 Litchi	
	4.1.7 Guava	
	4.1.8.1 Citrus, Species and varieties,	
	4.1.8.2 Climate, soil, rootstock, propagation, planting, training and pruning, flowering, harvesting, post harvest management	
	4.1.8.2 Major problem in citriculture	
	4.1.9 Pomegranate	
	4.2 Temperate fruits	
	4.2.1 Apple	
	4.2.2 Major problem in apple cultivation in Nepal	
	4.2.3 Pear and plums	
	4.2.4 Peach and nectarines	

4.2.5	Walnut
4.2.6	Kiwi
4.2.7	Grapes
4.3	Indigenous and under exploited fruit crops
4.3.1	Aonla, Custard apple, Wood apple, and other nut crops
4.3.2	Persimmon, Avocado, Sapota
4.3.3	Passion fruit, Apricot, Strawberry, Olive
4.4	Plantation crops
4.4.1	Tea
4.4.2	Processing and diseases and pest of tea
4.4.2	Coffee
4.4.3	Processing and diseases and pest of coffee
4.4.4	Cardamom

Total	30
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B. Practical

S.N.	Topics	No. of Practical
1.	Identification of tools, equipments and chemicals used in the production of fruit and plantation crops	1
2.	Field visit, identification of different fruit species and varieties	1
3.	Layout and planning of orchard	1
4.	Digging and filling of pits	1
5.	Practices of cutting and layering	1
6.	Practices of grafting and budding	1
7.	Processing of coffee and/or tea	1
8.	Detachment of layered plant and transplanting in the nursery	1
9.	Preparation of seedling/sapling plant for selling and transplanting	1
10.	Training and pruning practices	1
11.	Fertilizer application and irrigation practices	1
12.	Calculation, preparation of stock solution of plant growth regulators and their applications.	1
13.	Sampling technique for soil and plant parts for nutrient analysis	1
14.	Visit to subtropical and temperate horticultural farm	1
15.	Assignment: Preparation of project for establishing enterprises on fruit or plantation crop orchard (include establishing cost and return for a specific period)	1

Total	15
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REFERENCES

- Boss, T.K. and S.K. Mitra 1990: Fruits Tropical and Subtropical- nayaPrakash, Calcutta.
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- Kumar, N.K. Abdul; P. Rangaswami and I. Irulappan, 2000. Introduction to Spices, Plantation Crops, Medicinal and Aromatic Plants. Oxford & IBH Pub. Co. Pvt. Ltd.

Course Code : HRT 204

Course Title : Vegetable and Spice Crop Production

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 know basic knowledge and skills on the principles and practices of vegetable and spice crop production in Nepal.

I. SYLLABUS

Importance, prospects and constraints in vegetable and spice crop production in Nepal, basic principle of vegetable and spice crop production, classification of vegetables and spice crops, climatic and edaphic factors affecting production and quality, off- season and protected cultivation, nursery management, crop raising and its harvesting, area and production in Nepal, climate and soil, important varieties, field management, plant protection measures and physiological disorders if any, off- season/protected production, seed production, harvesting of: solanaceous crops, cole crops, bulb crops, leguminous crops, okra and spice crops, brief introduction to minor crops.

II. COURSE OUTLINE

A. Lecture

S.N.	Topics	No. of Lectures
1.	Importance, prospects and constraints in vegetable and spice crops production in Nepal	1
2.	Basic principles of vegetable and spice crop production	3
	2.1 Classification of vegetable and spice crops	
	2.2 Off-season and protected cultivation of vegetable crops	
	2.3 Nursery care and management	
3.	Production practices of the following vegetable and spice crops which include origin, distribution, area and production in Nepal, climate and soil, important varieties, field management, plant protection measures, physiological disorder (if any), seed production and harvesting:	21
	3.1 Potato	
	3.2 Tomato	
	3.3 Brinja	
	3.4 Chilli and sweet pepper	
	3.5 Cauliflower	
	3.6 Cabbage	
	3.7 Brocauli	
	3.8 Radish	
	3.9 Carrot	
	3.10 Turnip	
	3.11 Rayo	
	3.12 Cress, Spinach and Swiss chard	
	3.13 Cucumber, pumpkin and summer squash	
	3.14 Bottle gourd, bitter gourd, sponge gourd	
	3.15 Water melon and pointed gourd	
	3.16 Peas and beans	
	3.17 Onion	
	3.18 Garlic	
	3.19 Okra	

3.20	Ginger and turmeric	
3.21	Coriander, cumin and fenugreek	
4	Brief introduction to the following minor crops:	5
4.1	Ridge gourd, snake gourd, chayote, muskmelon and asparagus	
4.2	Sweet potato, colocasia, yam, cassava and garden beet	
4.3	Amaranthus, Brussel's sprout, lettuce, celery and knol-khol	
4.4	Broad bean, winged bean, hyacinth bean, cowpea and fennel	
4.5	Bamboo shoots, parsnip, tree tomato and dill	
Total		30

B. Practical

S.N.	Topics	No. of Practical
1.	Identification of seasonal vegetable and spice crop plants (fresh) and study morphology of the edible parts (major crops)	1
2.	Identification of seeds of vegetable and spice crops (prepare catalogue)	1
3.	Layout of kitchen garden	1
4.	Nursery raising of different vegetable crops	1
5.	Forcing of cucurbits in winter	1
6.	Computation and application of manure and basal dose chemical fertilizers	1
7.	Transplanting of the seedlings	1
8.	Mulching and watering	1
9.	Intercultural operations, top dressing and application of micro-nutrients	1
10.	Practices of staking and pruning	1
11.	Preparation and application of pesticides	1
12.	Use of PGR in vegetable crops	1
13.	Harvesting and postharvest handling of selected vegetable and spice crops	1
14.	Display and judging of the fresh vegetables	1
15.	Visit to near by commercial vegetable farm	1
Total		15

REFERENCES

AVRDC, 1992. Vegetable Production Training Manual. Asian Vegetable Research and Development Center, Shanhua, Tainan, Taiwan.

ICAR, 2001. Text Book of Vegetables, Tuber Crops and Spices, (Ed. S. Thamburaj and Narendra Singh), Indian Council of Agricultural Research, New Delhi, India.

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Course Code : HRT 305

Course Title : Postharvest Horticulture

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

OBJECTIVES

Upon the completion of this course, the students will know basic knowledge on postharvest physiology handling and storage of the fresh. produces, processing and preservation.

I. SYLLABUS

Importance and scope of postharvest horticulture. Postharvest physiology of fruits, vegetables and cut flowers. Maturity judgment and harvest indices. Causes of deterioration; transpiration, respirations, ethylene production, physiological disorders, postharvest pathology and postharvest entomology. Packaging and packing house operations; grading, sorting, curing, waxing, trimming, de-handing, chemical treatment, sugar pulsing, pre-cooling, fumigation and packaging. Storage of fruits and vegetables, factors affecting storage, different methods of storage. Marketing and markets for fruits, vegetables and cut flowers. Principles and methods of preserving fruits and vegetables. Quality control and assessment, organoleptic evaluation. Handling of specific fruits, vegetables and cut flowers. In practical the students will be taught about physiological aspects of fruits, vegetables and flowers as well as the principles and methods of processing and preservation.

II. COURSE OUTLINE

A. Lecture

S.N.	Topics	No. of Lectures
1.	History and Importance of postharvest horticulture	1
2.	Postharvest physiology of fruits, vegetables and flowers	9
	1.1 Growth and development of fruits and vegetable	
	1.2 Transpiration:	
	2.1 Factors affecting transpiration	
	1.2.2 Effects of transpiration on post-harvest life	
	1.3 Respiration:	
	1.3.1 Aerobic and anaerobic respiration and Electron transport system	
	1.3.2 Effects of respiration on postharvest life	
	1.4 Ripening:	
	1.4.1 Physiological changes during ripening	
	1.4.2 Control measures of ripening	
	1.5 Ethylene	
	1.5.1 Mode, mechanism, biosynthesis uses of ethylene	
	1.5.2 Effects in climacteric and non-climacteric fruits	
3.	Maturity determination:	2
	3.1 Physiological and commercial maturity, methods for maturity judgment	
	3.2 Method and time of harvesting	
4.	Causes of postharvest losses and techniques to reduce them	1

5.	Postharvest pathology:	
5.1	Postharvest disease	
5.2	Control measures of pos harvest diseases	2
6.	Physiological disorders:	2
6.1	Postharvest physiological disorders	
6.2	Preventive measures of physiological disorder	
7.	Postharvest Entomology: Nature of damage, control and preventive measures	1
8.	Introduction to packing house operations:	2
8.1	Packaging, Grading, Sizing, Curing, Trimming and Cleaning	
8.2	De-handing, Sorting, Waxing, Chemical treatments, Irradiation and fumigation	
9.	Design of packaging material and consideration in packaging	1
10.	Principle and method of curing	1
11.	Storage:	3
11.1	Principles of storage	
11.2	Factors affecting storage	
11.3	Different methods of storage and existing storage facilities in Nepal	
12.	Postharvest Quality: Quality criteria and judgment	1
13.	Markets and Marketing of horticultural produces	1
14.	Preservations:	2
14.1	Principles of preservations	
14.2	Methods of preservations	
15.	Commodity profile: Handling of major fruits, vegetables and cut flowers	1
Total		30

B. Practical

S.N.	Topics	No. of practicals
1.	Identification of equipments, tools and chemicals used in postharvest horticulture	1
2.	Determination of Total Soluble Solids (TSS) and Titratable acidity (TA)	1
3.	Experiments on cumulative weight loss and evaluation of visual quality	1
4.	Artificial ripening of banana	1
5.	Drying of vegetables	1
6.	Preparation of potato chips	1
7.	Preparation of tomato ketchup	1
8.	Preparation of squash	1
9.	Preparation of Jam	1
10.	Preparation of pickles	1
11.	Preparation of jelly and marmalade	1
12.	Visit to horticulture farm for evaluating various factors affecting qualities of fruits, Vegetables and cut flowers produced and identifying various disorders	1
13.	Maturity judgment and harvesting of fruits	1
14.	Maturity judgment and harvesting of vegetables	1
15.	Organoleptic evaluation and hedonic rating for different qualities	1
Total		15

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Bhattarai, D.R. 2012. Postharvest Technology: Marketing, Handling and Processing of Fruits and Vegetables, Public Printing Press, New Plaza, Kathmandu.

Kays, S.J. 1998. Postharvest Physiology of Perishable Plant Products, CBS Publishes & distributors, New Delhi 532 P.

Khawwada, B.P. and D.M. Gautam and D.D. Dhakal 2011. Ripening banana by chemicals and plant materials LAP LAMBERT Academic publishing, Germany 86 P.

Bautista, O.K. 1990. Postharvest Technology for Southeast Asian Perishable Crops, University of the Philippines, Technology and Livelihood Resource Center, Philippines.

Course Code : HRT 406
Course Title : Agroforestry
Credit Hours : 2 (1+1) Full Marks: 50 Theory: 25s Practical :25

OBJECTIVES

Upon the completion of this course, the student will have basic knowledge on principles and practices of agro forestry systems.

I.SYLLABUS

Concept of Agro-forestry: Definition, importance and scope. Roles of trees in fulfilling the basic requirements of people, characteristics of trees for Agro-forestry development and tree improvement. Agroforestry System (AFS): Classification of the Agroforestry system (AFS) and over-view of AFS in Nepal and similar agro-eco-zoning in the World. Tree-crop-interaction: Nature of interactions, factors, types, quantifying interactions. Soil management under AFS: Soil-water conservation approaches, soil-fertility management. Designing AFS: Conceptual framework for designing AFS. Project development: ICFAF's diagnosis and design, diagnostic methods and tools used in AFS. Management of trees in AFS: Tree-management, agricultural management, silvicultural and management operations. Quantifying agroforestry products.

II. COURSE OUTLINE

A. Lecture

S.N.	Topics	No. of Lectures
1.	Concept of Agroforestry: Definition, importance and scope.	1
2.	Tree selection and improvements:	2
	2.1 Roles of trees in fulfilling the basic requirements of people	
	2.2 Characteristics of trees for Agroforestry development and tree improvements	
3.	Agroforestry system (AFS):	2
	3.1 Classification and over-view of Agroforestry System (AFS)	
	3.2 Overview of AFS in Nepal and similar agro-eco-zoning in the world	
4.	Tree-crop-interaction:	2
	4.1 Factors and types on nature of tree-crop interaction	
	4.2 Quantifying Agroforestry products	
5.	Soil management under AFS:	2
	5.1 Approaches of soil-water conservation	
	5.2 Soil-fertility management	
6.	Designing AFS:	2
	6.1 Conceptual framework for designing AFS	
	6.2 Factors affecting AFS	
7.	Project development:	2
	7.1 ICFAF's diagnosis and design	
	7.2 Diagnostic methods and tools used in AFS	
8.	Management of trees in AFS:	2
	8.1 Management of trees in Agriculture	
	8.2 Agricultural and Silvicultural management in relation to crop	
Total		15

B. Practical

S.N.	Topics	No. of Practicals
1.	Tree selection and identification for AFS at different areas:	3
	1.1 High Hills	
	1.2 Mid Hills	
	1.3 Terai	
2.	Practice in contour farming system	1
3.	Preparation 'A'-frames and determines contour lines	1
4.	Lay-out of a soil-water conservation systems.	1
5.	Nursery establishment for AFS	3
	5.1 Collection and identification of seeds of Agroforestry trees	
	5.2 Preparation of nursery bed for Agroforestry tree	
	5.3 Seed sowing for Agroforestry trees	
6.	Tree-clinic for AFS.	1
7.	Training and pruning for Agroforestry trees	1
8.	Height and canopy measurement for selected Agroforestry trees	1
9.	Different AFS development (SALT and home garden)	1
10.	Establishment of Agroforestry farm at Agriculture and Forestry University (AFU)	1
11.	A visit to success story of Agroforestry project(s) at local level	1
	Total	15

REFERENCES

Dwivedi, A.P. 1992. Agroforestry: Principles and Practices. Oxford and IBH Publishing Co. Pvt. Ltd. India.

Chaudawat, B.S. and S.K. Gautam. 1996. Text of Agroforestry. Oxford and IBH Publishing Co. Pvt. Ltd. India.

Singh, S.P. 1998. HandBook of Agroforestry. Agrotech Publishing Academy, India.

Thapa, F. 2001. Nepalese Flora for Agroforestry Systems. S.B. Bhandari Publication, Nepal.

Prakash, Ram. 1991. Propagation Practices of Important Indian Trees. International Book Distributions, India.

GENETICS AND PLANT BREEDING

Course Code : PLB 101

Course Title : Introductory Genetics

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 science of genetics in terms of chromosomal characters, the fundamental principles of genetics, and solve the numerical problems related to inheritance of qualitative, quantitative and cytoplasmic characters.

I. SYLLABUS

Introduction, scope, relationship with other sciences and history of genetics; Cell cycle and Cell division (mitosis and meiosis); Life cycles (maize, human, virus and bacteria); Mendelian genetics; Gene action and interactions; Probability and chi square testing; Linkage and crossing over; Sex determination and sex linkage; Extra nuclear/maternal/cytoplasmic inheritance; Nucleic acids; Gene regulation and transposable genetic elements; Mutation; Chromosomal aberrations.

II. COURSE OUTLINE

A. Lecture

S. N.	Topics	No. of Lectures
1.	Introduction, scope, relationship with other sciences and history of genetics	1
2.	Cell cycle and Cell division	2
	2.1 Mitosis	
	2.2 Meiosis	
3.	Life cycles	3
	3.1 Maize and human	
	3.2 Virus	
	3.3 Bacteria	
4.	Mendelian genetics	3
	4.1 Introduction to Mendelian genetics	
	4.2 Mendel's laws of inheritance	
	4.3 Back cross and test cross	
5.	Gene actions and interactions	2
	5.1 Gene actions	
	5.2 Gene interactions	
6.	Probability and chi square testing	2
	6.1 Probability	
	6.2 Chi square test	
7.	Linkage and crossing over	2
	7.1 Linkage	
	7.2 Crossing over	

8.	Sex determination and sex linkage	3
	8.1 Sex determination in animals	
	8.2 Sex determination in plants	
	8.3 Sex linkage	
9.	Extra nuclear/maternal/cytoplasmic inheritance	2
	9.1 Genes in organelles and maternal effects	
	9.2 Characteristics of cytoplasmic inheritance, male sterility, restorer and non-restorer Genes	
10.	Nucleic acids	4
	10.1 Introduction to nucleic acids and Structure of DNA	
	10.2 DNA replication	
	10.3 RNA and its types, transcription	
	10.4 Translation and genetic code	
11.	Gene regulation and transposable genetic elements	2
	11.1 Gene regulation	
	11.2 Transposable genetic elements	
12.	Mutation and mutagens	2
	12.1 Definition, characteristics and types of mutation	
	12.2 Mutagens and their types; applications/uses of mutation	
13.	Chromosomal aberrations	2
	13.1. Structural	
	13.2. Numeric	
Total		30

B. Practical

S. N.	Topics	No. of practical
1.	Study of diagrams of mitosis	1
2.	Study of diagrams of meiosis	1
3.	Microscopic study of different stages of mitosis	1
4.	Microscopic study of different stages of meiosis	1
5.	Solution of numerical problems related to Mendel's law of segregation	
6.	Solution of numerical problems related to Mendel's law of independent assortment	1
7.	Solution of numerical problems related to gene actions	1
8.	Solution of numerical problems related to gene interactions	1
9.	Probability	1
10.	Chi square test	1
11.	Solution of numerical problems related to linkage	1
12.	Solution of numerical problems related to crossing over	1
13.	Solution of numerical problems related to sex determination and linkage	1
14.	Microscopic study of DNA and RNA	1
15.	Field demonstration of cytoplasmic/genetic male sterility	1
Total		15

REFERENCES

Gardner, E.J., M.J. Simmons and D.P. Snustad, 2011. Principles of Genetics (8th Ed.). John Wiley and Sons Pvt. Ltd. Singapore.

Griffiths, A.J.F., S.R. Wessler, S.B. Carroll and J. Doebley, 2012. An Introduction to Genetic Analysis (10th Ed.). W.H. Freeman and Company. New York. USA.

Singh, B.D., 2007. Fundamentals of Genetics (3rd Ed.). Kalyani Publishers. India.

Strickberger, M.W., 2012. Genetics (3rd Ed.). PHI Learning Private Limited. New Delhi. India.

Course Code : PLB 202

Course Title : Introductory Plant Breeding

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 know the basic concept of plant breeding and its relationships with other disciplines, and principles of genetics to crop improvement.

I. SYLLABUS

Introduction to plant breeding; Plant introduction, domestication and germplasm conservation; Modes of pollination and reproduction; Pollination control: male sterility and self incompatibility; Qualitative and quantitative characters; Biometrical techniques in plant breeding; Selection in self pollinated crops; Genetic composition and selection in cross pollinated crops; Hybridization techniques; Heterosis and inbreeding; Breeding methods in self and cross pollinated and asexually propagated crops; Mutation breeding; Polyploidy breeding; Ideotype breeding and breeding for pest resistance; Release of new varieties; Crop improvement; Participatory plant breeding and intellectual property rights.

II. Course Breakdown

A. Lecture

S. N.	Topics	No. of Lectures
1.	Introduction to plant breeding (definition, history, goals, nature, objectives, activities, achievements and relationship to other disciplines)	1
2.	Plant introduction, domestication and germplasm conservation.	2
	2.1 Plant introduction, domestication and acclimatization	
	2.2 Concept of Gene pool and Centers of origin	
3.	Modes of pollination and reproduction	1
4.	Pollination control: male sterility and self incompatibility	1
5.	Qualitative and quantitative characters	1
6.	Biometrical techniques in plant breeding	1
7.	Selection in self pollinated crops	1
	7.1 Pureline theory, progeny test, origin of variation	
	7.2 Genetic gain/advance, heritability	
8.	Genetic composition and selection in cross pollinated crops	2
	8.1 Hardy Weinberg law and equilibrium, factors affecting equilibrium, mating Systems	
	8.2 Selection response and gain from selection in cross pollinated crops	
9.	Hybridization techniques (definition, objectives, types, procedures and consequences)	1

10.	Heterosis and inbreeding	2
10.1	Definition, types, effects, theories governing of heterosis	
10.2	Definition and effects of inbreeding and inbreeding depression	
11.	Breeding methods in self and cross pollinated and asexually propagated crops	6
11.1	Breeding methods in Self Pollinated crops	
11.1.1	Mass selection, pureline selection and pedigree selection	
11.1.2	Back cross selection, bulk selection and single seed descent selection	
11.2	Breeding methods in cross Pollinated crops	
11.2.1	Mass selection, progeny selection, half sib and full sib selection	
11.2.2	Simple recurrent selection and selfed progeny selection	
11.3	Breeding methods in asexually propagated crops: clonal selection	
12.	Mutation breeding	2
12.1	Definition and types of mutagenes	
12.2	Mutation breeding and procedure and its applications	
13.	Polyploidy breeding	2
13.1	Definition of related terms; production and applications of haploids, aneuploids, autotriploids, autotetraploids	
13.2	Production and applications of allopolyploids; evolution of wheat, Brassica, Triticale, tobacco and Raphanobrassica)	
14.	Ideotype breeding and breeding for pest resistance	2
14.1	Ideotype breeding	
14.2	Breeding for disease and insect resistance	
15.	Release of new varieties (evaluation, identification and release)	1
16.	Crop improvement of some important crops in Nepal	3
16.1	Rice and wheat	
16.2	Maize and legumes	
16.3	Potato and tomato	
17.	Participatory plant breeding and Intellectual property rights	1
Total		30

B. Practical

S. N.	Topics	No. of practical
1.	Study and draw floral parts of self pollinated field crops	1
2.	Study and draw floral parts of cross pollinated field crops	1
3.	Estimation of heterosis and inbreeding depression	1
4.	Estimation of heritability and genetic gain from selection	1
5.	Plant breeding data recording	1
6.	Scoring data and determining resistance/susceptibility to pests	1
7.	Determining physical and genetic purity in the laboratory	1
8.	Hybridization techniques of self pollinated crops	1
9.	Hybridization techniques of cross pollinated crops	1
10.	Hybrid seed production using CMS and self incompatible lines	1
11.	Describing the traits for release of a new variety	1
12.	Visit and study of the research activities at National wheat research program	1
13.	Visit and study of the research activities at National maize research program	1
14.	Visit and study of the research activities at National grain legumes research program	1
15.	Visit and recording of the plant breeding activities of a given farmer	1
Total		15

REFERENCES

Chopra, V.L., 2000. Plant Breeding: Theory and Practices (2nd Ed.). Baba Barkha Nath Printing Press. New Delhi. India.

Gupta, S.K., 2003. Plant Breeding: Theory and Techniques. Agrobios. India.

Poehlman, J.M. and D.A. Sleper, 1995. Breeding Field crops (4th ed.). Panima Publishing Corporation. New Delhi. India.

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Course Code : PLB 303

Course Title : Molecular and Population Genetics

Credit Hours : 2 (2 + 0)

Full Marks: 50

Theory: 50

Practical: 0

OBJECTIVES:

Upon the completion of this course, the students will be able to understand quantitative and population genetics; chromosome and genetic, bioinformatics, genome and genomics.

I. SYLLABUS:

The nature of gene; Gene isolation and manipulation; Genetic engineering; Chromosome and genetic control mechanism in eukaryotes; Probability and Statistical testing; Quantitative genetics; Population Genetics

II. COURSE OUTLINE

A. Lecture

S. N.	Topics	No. of Lectures
1.	The nature of gene	3
	1.1 One gene one polypeptide hypothesis	
	1.2 Enzymatic explanation of genetic ratios	
	1.3 Genetic fine structures	
2.	Gene isolation and manipulation	5
	2.1 Restriction enzymes, identification and isolation of DNA	
	2.2 Gene cloning vectors	
	2.3 r-DNA technology and formation of r-DNA	
	2.4 Methods of cloning	
	2.5 PCR, Gel electrophoresis	
3.	Genetic engineering	2
	3.1 Definition, steps, methods of genetic engineering	
	3.2 Applications of genetic engineering for crop improvement	
4.	Chromosome and genetic control mechanism in eukaryotes	3
	4.1 Eukaryotic chromosomes and its types	
	4.2 Eukaryotic gene expression	
	4.3 Central dogma of molecular biology	
5.	Probability and Statistical testing	2
	5.1 Probability rules, calculation of genetic ratios	
	5.2 Chi square test	

6.	Quantitative genetics	7
6.1	Heterosis and inbreeding	
6.2	Johannsen's pureline theory, means, variance and regression analysis	
6.3	Heritability and prediction of response to selection	
6.4	Polygenes in discontinuous traits, quantitative traits and their inheritance	
6.5	Genotype x Environment Interaction	
6.6	Path Analysis	
6.7	Combining ability analysis (GCA, SCA)	
7.	Population Genetics	8
7.1	Population structures; evolution by natural selection	
7.2	The Mendelian population, Gene pool and genes in populations	
7.3	Gene frequency and genotype frequency	
7.4	Hardy-Weinberg Law, factors affecting gene frequencies, mating Systems	
7.5	Process that changes allelic frequencies: Selection, Migration, Mutation and Genetic drift	
7.6	Multiple alleles and linkage of gene	
7.7	Genetic diversity, genetic load and genetic death	
7.8	Chromosome change in evolution; species isolation mechanisms	
<hr/> Total		30

REFERENCES

- Dabholkar, A.R., 1999. Elements of Biometrical Genetics. Concept Publishing Company. New Delhi. India.
- Gardner, E.J., M.J. Simmons and D.P. Snustad, 2011. Principles of Genetics (8th Ed.). John Wiley and Sons Pvt. Ltd. Singapore.
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Course Code : PLB 304
Course Title : Introductory Resistance Breeding
Credit Hours : 2 (2 + 0) Full Marks: 50 Theory: 50 Practical: 0

OBJECTIVES

Upon the completion of this course, the students will be able to understand Principles and Practices of Resistance Breeding.

I. SYLLABUS

Introduction to resistance breeding; natural enemies and their types; defence mechanisms against pathogens, parasites, insects; a great diversity in mechanisms for resistance; sources and test of resistance; stage of development, application of natural enemies, composition of inoculums, evaluation aspects; breeding for disease and insect resistance; breeding for drought, heat, mineral stresses and cold; selection procedures; durability of resistance and application of non durable resistance; development of resistant varieties in Nepal.

II. COURSE OUTLINE

A. Lecture

S.N.	Topics	No. of Lectures
1.	Introduction to resistance breeding (Biotic and Abiotic)	1
2.	Natural enemies and their types	2
	2.1 Natural enemies	
	2.2 Types of natural enemies	
3.	Defence mechanisms against pathogens, parasites, insects	3
	3.1 Defence mechanisms against pathogens, parasites	
	3.2 Gene for gene hypothesis	
	3.3 Defence mechanisms against insects	
4.	A great diversity in mechanisms for resistance	2
	4.1 Broad resistance, Non host resistance, Host range	
	4.2 Hypersensitivity resistance and Partial resistance, Suppressors	
5.	Sources and test of resistance	2
	5.1 non host, mutations, genetic modification	
	5.2 field test and in vitro test	
6.	Stage of development, Application of natural enemies, Composition of inoculums and Evaluation aspects	3
	6.1 Stage of development and Application of natural enemies	
	6.2 Composition of inoculums	
	6.3 Evaluation aspects: Quantitative and Qualitative aspects	
7.	Breeding for disease and insect resistance	2
	7.1 Breeding for disease resistance	
	7.2 Breeding for insect resistance	

8	Breeding for drought resistance	1
9	Breeding for heat resistance	1
10	Breeding for mineral stresses	1
11	Breeding for cold resistance	1
12.	Selection procedures	3
	12.1 Back crossing and recurrent selection	
	12.2 Molecular markers	
	12.3 Marker assisted selection	
13.	Durability of resistance and application of non durable resistance	4
	13.1 Durability of resistance	
	13.2 Application of non durable resistance	
	13.2.1 gene pyramiding	
	13.2.2 multilines, cultivar mixtures	
	13.2.3 integrated control	
14.	Development of resistant varieties in Nepal	4
	14.1 Cereal crops	
	14.2 Vegetable crops	
	14.3 Legumes	
	14.4 Oil seed crops	
<hr/> Total		30
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- Jacobsen, E. 2010. Genetic Variation and Genetic Modification In Vitro. Wageningen University and Research Centre. Wageningen. The Netherlands.
- Johnsen, R., 1984. A critical analysis of durable resistance. *Phytopath.* 22: 309-330.
- Knott, D. R., 1989. The effect of transfers of alien genes for leaf rust resistance on the agronomic and quality characteristics of wheat. *Euphytica.* 44: 65-72.
- Niks, R. E. and W. H. Lindhout, 2010. Breeding for Resistance against diseases and pests. Wageningen University and Research Centre. Wageningen. The Netherlands.
- Singh, B.D., 2005. Plant Breeding: Principles and Methods (7th Ed.). Kalyani Publishers. New Delhi. India.

Course Code : BIT 401
Course Title : Introductory Biotechnology and Biodiversity
Credit Hours : 2 (2 + 0) Full Marks: 50 Theory: 50 Practical: 0

OBJECTIVES

Upon the completion of this course, the students will be able to understand the basic concepts of biotechnology and biodiversity.

I. SYLLABUS

Biotechnology: Introduction to biotechnology; Plant biotechnology; Genetic engineering and gene cloning; Plant cell and tissue culture; Applications of tissue culture for crop improvement; Polymerase chain reaction and gel electrophoresis; Molecular markers and Marker assisted selection.

Biodiversity: Introduction to biodiversity; Database and biodiversity indexing; Species and genetic diversity and centres of diversity of crops and wild genetic diversity; Conservation of biodiversity.

II. COURSE OUTLINE

A. Lecture

S. N.	Topics	No. of Lectures
A. Biotechnology		
1.	Introduction to biotechnology	2
	1.1 Definition, history and fields of biotechnology	
	1.2 Current activities and future scope of biotechnology in the context of Nepal	
2.	Plant biotechnology (definition, types, relationship to other disciplines, future scope of plant biotechnology in the context of Nepal)	1
3.	Genetic engineering and gene cloning	5
	3.1 Restriction enzymes and its types	
	3.2 Definition, history, basic steps involved and methods of genetic engineering	
	3.3 Gene cloning vectors	
	3.4 Methods of gene cloning	
	3.5 Applications of genetic engineering in the field of crop improvement	
4.	Plant cell and tissue culture	4
	4.1 Definition, history, basic steps/techniques and types of tissue culture	
	4.2 Callus, cell suspension and protoplast culture	
	4.3 Anther/pollen culture	
	4.4 Meristem and embryo culture	

5.	Applications of tissue culture for crop improvement	4
5.1	Haploid and triploid production, invitro pollination and fertilization	
5.2	Somatic hybridization and cybridization	
5.3	Genetic transformation and wide hybridization	
5.4	Somaclonal/gametoclonal variants selection, production of pathogen free plant	
6.	Polymerase chain reaction and Gel electrophoresis	1
7.	Molecular markers and marker assisted selection	3
7.1	Molecular markers	
7.2	Marker assisted selection (MAS) and mapping strategy	
7.3	Applications of molecular markers/MAS	

B. Biodiversity

8.	Introduction to biodiversity	3
8.1	Basic concepts and aim of biodiversity; familiar to some terms: alpha, beta, gamma, guild and endemic diversity	
8.2	Scope and factors affecting biodiversity	
8.3	Biological hierarchy of biodiversity (genes-populations-species-communities-ecosystems-landscapes-biosphere)	
9.	Database and biodiversity indexing	2
9.1	Database	
9.2	Biodiversity indexing	
10.	Genetic diversity and centers of diversity of crops	2
10.1	Species and genetic diversity; wild genetic diversity of some important crops	
10.2	Centres of diversity of crops	
11.	Germplasm collection, conservation and utilization	3
11.1	Concept of conservation: Ex-situ and in-situ conservation	
11.2	Risk of extinction and Recovery program	
11.3	National legislation and intellectual property rights, conflict and nature of policies	
Total		30

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- Chaudhary, R.P., 1998. Biodiversity in Nepal: Status and Conservation. S. Devi. Sharanpur. India.
- Ignacimuthu, S. 1996. Basic Biotechnology. Tata McGraw Hill Publishing Company Limited. India.
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- Mascarenhas, A.F., 1997. HandBook of Plant Tissue Culture. Indian Council of Agriculture Research. New Delhi. India.
- Pareek, L.K. and P.L. Swarnkar. 1997. Trends in Plant Tissue Culture and Biotechnology. Agro Botanical Publishers. India.

PLANT PATHOLOGY

Course Code : PLP 201

Course Title : Introductory Plant Pathology

Credit Hours : 3(2 + 1)

Full Mark: 75

Theory: 50

Practical: 25

OBJECTIVES

Upon completion of this course, the students will be familiar with plant pathogens, their characteristics and principles of management.

I. SYLLABUS

Introduction, causes, general symptoms of plant diseases; fungal pathogens, their characteristics, classification, major genera of lower fungi, higher fungi and imperfect fungi; characteristics of bacterial pathogens, nematodes, viruses and other pathogens; general principles of plant pathology, survival and defense mechanisms, general principles of plant disease management, chemical and integrated plant disease management.

II. COURSE OUTLINE

A. Lecture

S. N.	Topics	No. of Lecture
1.	Introduction, definition of plant pathology and plant disease	1
2.	Causes, classification and general symptoms of plant diseases	1
3.	Definition, importance and general morphological characters of fungi	1
4.	Asexual and sexual reproduction and types of fruiting bodies in fungi	1
5.	Classification of fungi with their diagnostic characters	1
6.	Myxomycota: Plasmodiophora, Spongospora and Synchytrium	1
7.	Diplomastigomycotina: Pythium and Phytophthora	1
8.	Diplomastigomycotina: Albugo, Sclerospora, Plasmopara and Peronospora	1
9.	Ascomycotina: Taphrina, Protomyces, Erysiphae and Claviceps	1
10.	Basidiomycotina: Puccinia and Melampsora	1
11.	Basidiomycotina: Uromyces, Ustilago and Tilletia	1
12.	Deuteromycotina: Colletotrichum, Alternaria, Cercospora and Fusarium,	1
13.	Deuteromycotina: Helminthosporium, Pyricularia, Sclerotium, Sclerotinia and Rhizoctonia	1
14.	Definition, general morphology of bacterial cell and their functions	1
15.	Classification and characters of Xanthomonas, Pseudomonas, Erwinia, Agrobacterium, Corynebacterium and Streptomyces	1
16.	Virus, Mycoplasma and Spiroplasma: definition and general characters	1

17.	Multiplication and transmission of virus	1
18.	General characteristics, life cycle and reproduction of nematode	1
19.	Characteristics of Anguna, Heterodera, Globodera and Meloidogyne	1
20.	Pathogenecity and Pathogenesis	1
21.	Survival and dissemination of plant pathogens	1
22.	Dissemination of plant pathogens	1
23.	Epidemiology of plant pathogens	1
24.	Pre-exposed defense mechanisms in plants	1
25.	Post-exposed defense mechanisms in plants	1
26.	Physiology of infected plants	1
27.	Enzymes and microbial toxins	1
28.	Disease forecasting	1
29.	Principles of disease management	1
30.	Chemicals and Integrated disease management	1
Total		30

B. Practical

S.N.	Topics	No. of practical
1.	Acquaintance with laboratory equipments, microscopes and their part	1
2.	Observation of plant disease symptoms in field	1
3.	Identification of lower fungi based on their fruiting bodies	1
4.	Identification of higher fungi based on their spores and fruiting bodies	1
5.	Identification of higher fungi based on their fruiting bodies	1
6.	Identification of Deuteromycetes fungi: Alternaria, Cercospora, Colletorrichum and Fusarium	1
7.	Identification of Deuteromycetes fungi: Helminthosporium, Pyricularia, Rhizoctonia, Sclerotinia and Sclerotium	1
8.	Preparation of general media for fungi	1
9.	Isolation of fungal pathogens	1
10.	Observation of plant disease symptoms in field	1
11.	Extraction and identification of Pathogenic and saprophytic nematodes from seeds and soil	1
12.	Preparation of general media for bacteria	1
13.	Isolation of bacteria from plants	1
14.	Staining and Identification of gram-positive and negative bacteria	1
15.	Identification of important chemicals to control plant diseases	1
Total		15

REFERENCES

Chaube H.S. and Ramji Singh 2001, Introductory Plant Pathology Int. Book Distributing Co. Lucknow

Singh, R.S. 1999 Introduction to Principles of Plant Pathology. Oxford & IBH.Pub, New Delhi

Course Code : PLP 302

Course Title : Crop Diseases and their 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 identify major diseases of crop plants and suggest proper management practices for them.

I. SYLLABUS

Causes, symptoms, epidemiology, disease cycle and management practices of major diseases of ceceal crops oil seed crops, industrial crops, vegetable crops, pulse crops, fruit crops, plantation crops and spices.

II. COURSE OUTLINE

A. Lecture

S. N.	Topics	No. of Lecture
1.	Powdery mildew diseases of cucurbits, pea, apple, citrus, etc	1
2.	Downy mildew diseases of cucurbits, crucifers, maize, etc	1
3.	Damping off of seedlings and Rhizoctonia diseases of vegetables and jute	1
4.	Purple blotch and stemphylium leaf blight of onion and garlic, stemphylium blight of lentil	1
5.	Root knot of vegetables and cereals, ear cockle of wheat	1
6.	Sclerotinia disease of beans, mustard and other crops	1
7.	Alternaria leaf spot, club root and white rust of crucifers	1
8.	Fusarium wilt of cotton, lentil, arhar, and chickpea	1
9.	Fusarium wilt of guava and banana, and red rot of sugarcane	1
10.	Bacterial wilt of solanaceous crops and banana, black rot of colecrops	1
11.	Early and late blights of potato and tomato, Phytophthora blight of Colocasia	1
12.	Viral diseases of tomato, potato, beans, soybean,	1
13.	Little leaf of brinjal, yellow vein mosaic of okra, and chirki and furki disease of cardamom	1
14.	Pome fruits: Apple scab, fire blight, root rot and crown gall.	1
15.	Collar rot of citrus, apple and papaya	1
16.	Citrus root rot, canker, tristeza and greening	1
17.	Anthracnose of mango, guava and papaya, and malformation of mango	1
18.	Red rust of litchi and tea, rust of guava, pea, beans and maize	1
19.	Papaya ring spot, banana bunchy top and stem gall of coriander	1
20.	Sigatoka leaf spot of banana and leaf spot and blight of strawberry	1
21.	Anthracnose of bean, chilli and tomato, leaf spot of chilli, brinjal and ground nut	1
22.	Ginger and turmeric: rhizome rot, blast and leaf blotch	1
23.	Rice: blast, leaf spot and false smut	1
24.	Rice: bacterial leaf blight and bacterial leaf streak	1

25.	Wheat: spot blotch, tan spot and loose smut	1
26.	Wheat: brown, yellow and black rusts	1
27.	Maize: Northern and Southern leaf blights and gray leaf spot	1
28.	Maize: banded leaf and sheath blight	1
29.	Deficiency/disorder diseases (black tip of mango, tip burn and khaira disease of paddy, browning, whiptail and buttoning of cauliflower, black heart of potato and blossom end rot of tomato)	1
30.	List of major diseases and their causal agents of major ornamental plants with major control measures to the point	1
Total		30

B. Practical

S.N.	Topics	No. of Practicals
1.	Field visit: to identify fungal, bacterial, viral, nematode and nonpathogenic	1
2.	Collection, identification and preservation of disease specimens.	1
3.	Teasing of disease samples and identification of causal organism.	1
4.	Transverse section cutting of disease samples to study host-parasite relationship of: Helminthosporium and Pyricularia Puccinia, Uromyces and Protomyces Alternaria and Cercospora Fusarium and Colletotrichum Phytophthora and Peronospora	5
5.	Preparation of temporary slides of fungi.	1
6.	Microscopic and ooze test of disease samples for detection of bacterial infection.	1
7.	Identification of plant parasitic and nonparasitic nematodes.	1
8.	Extraction and observation of various stages (eggs, juveniles and adult female) of root knot nematode.	1
9.	Dilution of chemicals.	1
10.	Handling and calibration of sprayers.	1
11.	Preparation of Bordeaux mixture and Bordeaux paste.	1
Total		15

REFERENCES

- Singh, R. S. 2005. Plant Diseases, 8th Edition. Oxford and IBH Publishing Co. Pvt.Ltd. New Delhi.
- Mehrotra, R. S. and A. Aggarwal. 2003. Plant Pathology. 2nd Edition. Tata McGraw-Hill Publishing Co. Ltd, New Delhi.
- Verma, L. R. and R. C. Sharma Edition 1999. Diseases of Horticultural Crops: Vegetables, Ornamentals and Mushrooms. Indus Publising Co. New Delhi.
- Verma, L. R. and R. C. Sharma edition 1999. Diseases of Horticultural Crops: Fruits. Indus Publising Co. New Delhi.
- Agrios, N. George 2008. Plant Pathology Elsevier Academic Press, New York, USA/ London, U.K.

Course Code : PLP 303

Course Title : Mushroom Cultivation

Credit Hours : 1 (0 + 1)

Full Marks: 25

Theory: 0

Practical: 25

OBJECTIVES

Upon completion of this course, the students will be able to cultivate mushroom particularly Pleurotus and Agaricus species.

I. SYLLABUS

Isolation and maintenance of pure culture of Pleurotus and Agaricus species, Preparation of spawn, compost, Preparation of beds and growing of the mushrooms, Harvesting and management of insects and diseases of mushrooms.

II. Course outline

A. Practical

S.N.	Topics	No. of practical
1.	Sterilization and preparation of PDA	1
2.	Isolation of Pleurotus and Agaricus	1
3.	Maintenance of pure culture of Pleurotus and Agaricus	1
4.	Preparation of spawn for Pleurotus sp.	1
5.	Preparation of spawn for Agaricus sp.	1
6.	Preparation of materials for composting for Agaricus sp.	1
7.	Methods of composting for Agaricus sp.	1
8.	Substrate preparation for Pleurotus sp.	1
9.	Sterilization and mixing of substrates for Pleurotus sp.	1
10.	Preparation of beds for Agaricus sp.	1
11.	Spawning of Pleurotus and Agaricus spp.	1
12.	Watering and Management	1
13.	Harvesting of mushroom	1
14.	Management of insect and diseases of mushroom	1
15.	Recycling of mushroom compost	1
Total		15

REFERENCES

Kapoor, J.N. 1989. Mushroom Cultivation, ICAR publications New Delhi.

Khadge, B.R. 2005. Simple Mushroom Technology, Siddharth Printing Press, Lalitpur.

SOIL SCIENCE AND AGRICULTURAL ENGINEERING

Course Code : SSC 101
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 soils in relation to crop production, identify soil reaction for the amendment of different types of soil condition, and ecological perspectives in relation with geology.

I. SYLLABUS

Introduction: Definitions of related terminologies, historical development of soil science and geology; concepts of soil as a medium for plant growth and soil as a natural body; Soils in relation to agricultural production, soil physical properties; soil chemical properties; Soil colloids: ion exchange phenomena; Geology in relation to soils; Physiographic units of Nepal; Perspectives on the relationships between soil science and geology; soil ecology: The ecosystem, soil animals, nutrient cycling, soil organisms and environmental quality.

II. COURSE OUTLINE

A. Lecture

S. N.	Topic	No. of Lectures
1.	Introduction of Soil: Definition, concept and uses of soil,	1
2.	Historical development of soil science, Braches of soil science	1
3.	Soil as a medium for plant growth and soil as a natural body	2
4.	Three phase system of Soil: Solid, Liquid and Gaseous Phase	2
5.	Soil physical properties: Mechanical composition and textural classification, Soil Aggregation and Structure, Soil Color, Bulk density, particle density and porosity, Soil consistency, Soil aeration,	6
6.	Soil chemical properties: Soil pH, Soil reaction- acidic soils, saline soils, sodic, saline-sodic soils and their management. Buffering Capacity of soil and Liming	5
7.	Soil colloids: Properties of Soil Colloids and its types, Layer silicates	4
8.	Ion Exchange Phenomena, Cation and Anion Exchange Capacity of soil and its importance in Agriculture	2
9.	Geology in relation to soils: Evolution of earth, Composition of earth, Soil forming rocks and minerals and weathering of rocks and minerals.	4
10.	Physiographic units of Nepal: Terai, Siwalik, Middle Mountain and Higher Mountain	1
11.	Soil ecology: Ecosystem, producers, consumers; Microorganism and their importance in decomposition.	2
Total		30

B. Practical

S. N.	Topic	No. of Practicals
1.	Identification and function of soil science laboratory equipment.	1
2.	Collection and Preparation of soil sample	1
3.	Soil textural determination by Field methods	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 minerals	1
13.	Identification of soil forming rocks	1
14.	Study of soil as a natural body	1
Total		15

REFERENCES

Nyle C. Brady and Ray R. Weil. 2012. The Nature and Properties of Soils. 14th Ed. Prentice Hall of India Ltd.

Soil, Human Society and the Environment. Geological Society, London, Special Publications, 2006.

Henry D. Foth. 1990. Fundamentals of Soil Science. 8th Ed., John Wiley & Sons, Inc.

Robert E. White. 2006. Principles and Practice of Soil Science: The Soil as a Natural Resource. Blackwell Publishing, USA.

V. Obruchev. 2005. Fundamentals of Geology. Foreign Languages Publishing House.

Carla W. Montgomery and Kenneth F. Griffin. 1996. Fundamentals of Geology. McGraw-Hill Higher Education.

Course Code : SSC 102
Course Title : Soil Fertility, Fertilizers and Integrated Nutrient 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 in relation to soil fertility; inorganic and organic fertilizers, and role of organic matter and bio-fertilizers in crop production.

I. SYLLABUS

Historical development of 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; prospects of bio-gas in the Nepalese economy and environmental trade-off; preparation of manure, green manure and composted manure; methods of soil fertility evaluation for crop production; integrated nutrient management; soil fertility problems of Nepal; soil management for sustainable agricultural development.

II. COURSE OUTLINE

A. Lecture

S. N.	Topic	No. of Lectures
1.	Historical development of soil fertility and plant nutrition	1
2.	Essential plant nutrients: a) Criteria of essentiality, b) macro/ primary and secondary plant nutrients, c) their sources, functions, deficiency symptoms and control measure , and availability to plants.	5
3.	Introduction to micro nutrients, their function, deficiency symptoms and control measure in plant.	2
4.	Fertilizers: a) Nitrogenous, phosphetic and potassic fertilizers, b) their composition, uses and behaviors in soil.	4
5.	Organic matter; source and composition and function.	2
6.	Organic manure : source, classification and preparation; bio-fertilizer and green manuring; bio-gas and its importance in Nepal	2
7.	Soil fertility evaluation: soil testing, plant analysis visual diagnosis, and biological test method	3

8.	Soil fertility problems with respect to Nepalese agricultural system;effect of continuous use of organic versus inorganic fertilizers on soil fertility	3
9.	Soil management for sustainable agriculture	3
10.	Factors affecting fertilizer use efficiencies; tillage and tractionaffecting soil fertility	2
11.	Integrated nutrient management(INM), concept and relevance,componentsand management options of INM	3
Total		30

B. Practical

S. N.	Topic	No. of Practicals
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	2
4.	Chemical calculation and preparation of standard solution.	1
5.	Determination of organic matter content in soil	1
6.	Basic principles of micro- Kjeldahl distillation assembly, spectrophotometer,flame photometer	2
7.	Determination of available nitrogen in soil	2
8.	Determination of available phosphorus in soil	1
9.	Determination of available potassium in soil	1
10.	Plant sampling and their preparation for elemental analysis	1
11.	Collection and identification of nutrient deficiency symptoms on major crops in and around AFU farm.	2
Total		15

REFERENCES

Nyle C. Brady and Ray R. Weil. 2012. The Nature and Properties of Soils. 14th Ed. Prentice-Hall, Inc.

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

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

Rabindra N. Roy. 2006. Plant Nutrition for Food Security: a guide for integrated nutrient management. Food and Agriculture Organization of the United Nations.

Course Code : AMT 201

Course Title : Introductory Agro meteorology

Credit Hours : 2(2+0)

Full Marks: 50

Theory: 50

Practical: 0

OBJECTIVES

Upon the completion of this course, the students will be able to know atmospheric processes that produce various climate and weather conditions, their agricultural significance, and use of agro-meteorological forecasting tools in agricultural decision making.

I. SYLLABUS

Definitions, scope and role of meteorology in agriculture; meteorological variables and measurements: housing for temperature and humidity measurement; statistical calculations of meteorological variables; evaporation: factors affecting evaporation and transpiration rates and measurements of evapotranspiration demands of crop; precipitation: form, measurement, and significance in crop production; agro-meteorological normals of various crops, crop zonation, human influence on climate change and greenhouse effect on global warming and agriculture; elements and types of weather and climate forecasting for agriculture; use of remote sensing(RS) and geographic information system(GIS) techniques in evapo-transpiration estimation; satellite systems; weather, climate and drought classifications; theory and practices of automatic weather station technologies.

II. COURSE OULINE

A. Lecture

S. N.	Topic	No. of Lectures
1.	Definitions, scope and role of Agro- meteorology in agriculture	2
2.	Agro-meteorological variables and its measurement: Air temperature, relative humidity (RH), Solar radiation, Soil moisture, soil temperature, precipitation, wind speed and direction, sunshine duration; evaporation and factors affecting evaporation and transpiration rates; Agro-meteorological station and measurements of these variables; significance of its in Agriculture; Required exposure for measurement. Agro-meteorological normal for main crops.	6
3.	Housing for temperature and humidity measurement, units, maximum, minimum and average values of these parameters required for different crops, calculation of R. H. from dry and wet bulb thermometers, statistical calculation of meteorological variables (average, standard deviation, total rainfall) etc.	3

4.	Weather and climate forecasts for agriculture: Elements of agricultural weather forecast, Types of weather forecasts- Now-casting (NC), Very short-range forecast (VSRF), Short-range forecast (SRF), Medium-range forecast (MRF), Long-range forecast (LRF). Usefulness of weather forecast based on its types; weather forecasting scenario of Nepal;	3
6.	Definition of weather and climate, climatic classifications, Koppens classification, Thronthwaite classification, climates of Nepal	2
7.	Drought and Flood, Major drought and flood events affecting the crop production in Nepal. Types of drought, agricultural drought, hydrological drought, meteorological drought, Drought classification, aridity index	2
8.	Agro-meteorological models such as DSSAT and CROPWAT model etc	2
9.	Climate change and its impacts on agriculture: climate variability, changes in atmospheric composition, observed changes and future climate scenario; impact on hydrology, crop and livestock; impacts in Nepal	3
10.	Agro-climatic zoning of Nepal	2
11.	Automatic weather station technologies: Automatic weather station and its benefits over manual observations and limitations; components of automatic weather station such as data logger, data communications, power and sensors; Sensors for measurement of meteorological variables for agriculture and its working principle.	4
<hr/> Total		30

REFERENCES

Harpal S. Mavi and Graeme J. Tupper. 2004. Agro-meteorology: Principles and Applications of Climate Studies in Agriculture. The Haworth Press, Inc.

Harpal S. Mavi. 1998. Introduction to Agro-Meteorology. Oxford and IBH Publishing Co. New Delhi

Guidelines for Curricula in Agricultural Meteorology. World Meteorological Organization (WMO) No. 258. Geneva – Switzerland. 2008

Rao G.S.L.H.V. parasad 2008. Agricultural Meteorology, Prince Hall of India Pvt. Ltd. New Delhi, India.

Sabins J.R. (latest edition). Remote Sensing Principles and Interpretation. W.H. Freeman and Co.

Heywood, Ian, Corenelius Sarah and Carver Steve. 1999. An Introduction to Geographic Information System. Addison-Wesley-Longman

Chrisman Nicholas. 1997. Exploring Geographic Information System. John Wiley & Sons.

Course Code : SSC 203
Course Title : Soil Physics, Genesis and Classification
Credit Hours : 2 (1+1) Full Marks: 50 Theory: 25 Practical: 25

OBJECTIVES

Upon the completion of this course, the students will be able to know basic knowledge of soil physics especially soil water movement, genesis, soil forming process and mineral weathering and use diagnostic soil properties for developing soil classification systems.

I. SYLLABUS

Quantitative concept of soil physics, Energy concepts and measurement of soil moisture, total soil water potential, gravitational potential, pressure potential and osmotic potential, quantitative expression of soil-water potential; soil moisture characteristic curve; flow of water in saturated, unsaturated and vapor forms; infiltration characteristics, classes and role of soil moisture and temperature regimes; soil forming processes; macro and micro morphological properties of soils; modern soil classification system; kinds and distribution of soils of Nepal and potential uses.

II. COURSE OUTLINE

A. Lecture

S. N.	Topic	No. of Lectures
1.	Quantitative concept of soil physics, Energy concepts and measurement of soil moisture: total soil water potential, gravitational potential, pressure potential and osmotic potential, quantitative expression of soil-water potential and measurement of soil moisture	1
2.	Soil moisture characteristic curves and soil moisture tension	1
3.	Flow of water through the soil: saturated, unsaturated and vapor forms	1
4.	Air and heat movement in soil and Infiltration characteristics of soil	1
5.	Soil aeration: significance, composition and mechanism of renewal; emission of greenhouse gas from soils	1
6.	Soil forming Factors and processes, weathering of rocks and minerals	2
7.	Soil profile and its horizon: Soil Profile, diagnostic horizons and designations; Surface and sub-surface diagnostic horizons	2
8.	Soil moisture and temperature regimes	1
9.	Introduction and history of soil classification and modern soil classification systems	1
10.	Classification of soil according to soil taxonomy: FAO/UNESCO system of soil classification	2
11.	Soils of Nepal and their suitability for different purposes	2
Total		15

B. Practical

S. N.	Topic	No. of Practicals
1.	Determination of soil wetness by gravimetric, volumetric and soil depth	1
2.	Determination of water availability by resistance method	1
3.	Mass and volume relationships of soil constituents: sample problems	1
4.	Measurement of soil-moisture potential by field tensiometer	1
5.	Calculation of water quantities	1
6.	Observation of capillary process of soil	1
7.	Demonstration and explanation of already developed different types and scale of soil maps, aerial photograph topographic maps and report.	1
8.	Observation and description of the color plates for dominant genetic processes involved in soil development	1
9.	Determination of saturated Hydraulic Conductivity of soil	2
10.	Learning practices of describing sample soil profiles for comparative interpretations and classification under distinctive landscapes	2
11.	Development of soil maps and reports	1
12.	Group presentation	2
Total		15

REFERENCES

Daniel Hillel. 2004. Introduction to Environmental Soil Physics. Elsevier Academic Press.

Stanley W. Buol, R.J. Southard, R.C. Graham, and P.A. McDaniel. 2011. Soil Genesis and classification. 6th Ed. Wiley-Blackwell.

Nyle C. Brady and Ray R. Weil. 2012. The Nature and Properties of Soils. 14th Ed. Prentice-Hall, Inc.

S. W. Buol, F. D. Hole, R. J. McCracken and R. J. Southard. 1997. Soil Genesis and Classification. 4th Ed. Iowa State University Press / Ames.

Course Code : AEN 301
Course Title : Farm Power and Machinery
Credit Hours : 2 (1+1) Full Marks: 50 Theory: 25 Practical: 25

OBJECTIVES

Upon the completion of this course, the students will be familiar with farm machines and equipments used in farm operations, their working principles and maintenance and upkeep.

I. SYLLABUS

Sources of farm power: Scope, availability, and limitations of farm powers; Objectives, Scope and limitations of farm mechanization in Nepal. Assessment of Farm Power Sources in Nepal; Internal combustion engines: Engine types, principles of operation of two-stroke and four-stroke cycle compression ignition (diesel) and spark ignition (petrol) engines. Systems in two-wheel and four-wheel tractor engines- fuel supply, air cleaning, cooling, lubrication; farm tractors and their management: types and suitability of farm tractors in Nepalese agriculture; Tillage and tillage implements: Conservation versus Conventional Tillage. Operation and management of primary tillage implements- Indigenous tillage implement used in Nepal, mould board plows and their components, Disc Ploughs and their components. Operation and management of secondary tillage implements- harrows, cultivators, rotary tillers and rotavator. Special tillage implements and Tool: chisel plow, sub-soiler, ridger and bund former, puddler and leveler; Sowing and planting machines: methods of seeding and planting and metering mechanisms for seed and fertilizer in drills and planters, zero-till, reduced/minimum till drills and planters, potato and sugarcane planters, rice drum seeder and paddy trans-planters; Plant protection equipments: Working Principle and components of sprayers and their types, Safety in handling plant protection machines; Harvesting Machines: Indigenous harvesting tools used in Nepal, Mowers- types, working principle and constructional details, Reapers and Reaper binder- Types, working principle and constructional details; Potato Digger- working principle and constructional details; Selection and Economics of Farm Machines and Equipment: Field capacity and efficiency; Cost of operation of Farm Machines- fixed and variable costs, Feasibility of custom hiring of farm machines and equipment in Nepal.

II. COURSE OUTLINE

A. Lecture

S. N.	Topic	No. of Lectures
1.	Sources of farm power: Scope, availability, and limitations of farm powers – human, animal (animal power harnessing system), mechanical, electrical, wind, micro-hydro, biogas, and solar. Objectives, Scope and limitations of farm mechanization in Nepal. Assessment of Farm Power Sources in Nepal.	1
2.	Internal combustion engines: Engine types, principles of operation of two-stroke and four-stroke cycle compression ignition (diesel) and spark ignition (petrol) engines. Components of internal combustion engines and their functions. Systems in two-wheel and four-wheel tractor engines- fuel supply, air cleaning, cooling, lubrication.	2
3.	Farm tractors and their management: Farm tractor types, control systems on tractors; power transmission, clutch and brake, steering, power-take-off, differential, hydraulic, and hitch systems, suitability and tractor selection for Nepalese agriculture	2
4.	Tillage and tillage implements: Definition and Objectives of tillage, Conservation versus Conventional Tillage. Indigenous tillage implement used in Nepal.	1
5.	Operation and management of primary tillage implements-, mould board plows and their components, Disc Ploughs and their components. Operation and management of secondary tillage implements- harrows, cultivators, rotary tillers and rotavator. Operation of animal and tractor drawn disk harrows, spike tooth harrows and Spike tooth harrow. Special tillage implements and Tool: chisel plow, sub-soiler, ridger and bund former, puddler and leveler	2
6.	Sowing and planting machines: methods of seeding and planting and its type, metering mechanisms for seed and fertilizer in drills and planters, types of furrow openers and covers on seed/seed-cum-fertilizer drills and planters, zero-till, reduced/minimum till drills and planters, potato and sugarcane planters, rice drum seeder and paddy trans-planters	2
7.	Plant protection equipments: types of sprayers and dusters, Working Principle and components of sprayers, nozzles used on sprayers and their selection, Safety in handling plant protection machines	1
8.	Harvesting Machines: Indigenous harvesting tools used in Nepal, Mowers- types, working principle and constructional details, Reapers and Reaper binder- Types, working principle and constructional details; Potato Digger- working principle and constructional details	1
9.	Threshing machines: Threshing methods and their mechanization, Types of threshers, their working principles and constructional details, Factors affecting thresher performance. Mize Sheller and its construction detail	1
10.	Combine harvester: Components and working Principle.	1
11.	Selection and Economics of Farm Machines and Equipment: Field capacity and efficiency, Cost of operation of Farm Machines- fixed and variable costs, Feasibility of custom hiring of farm machines and equipments in Nepal	1
Total		15

B. Practical

S. N.	Topic	No. of Practicals
1.	Identification of workshop tools	1
2.	Identification of internal combustion engine components	1
3.	Study of Indigenous tillage tool and mould board plow	1
4.	Study of disk plow and disk harrow	1
5.	Study of rotary tillers and rotavator	1
6.	Study of seed drills and planters- zero-till drill, seed calibration	2
7.	Study of rice drum seeder and transplanter	1
8.	Study of knap-sack sprayers and their operation	1
9.	Study of power operated reaper	1
10.	Study of maize shellers and paddy or multi-crop threshers	1
11.	Study of external tractor components and controls	2
12.	Study of power tiller controls	1
13.	Tractor and power tiller operation	1
Total		15

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Jagdishwar, S. 1981. Elements of Agricultural Machinery. Agro Book Agency, Patna

Michael, A. M. and T. P. Ojha 2009. Principles of Agricultural Engineering (Vol. 1 & Vol. 2) Jain Brothers, New Delhi

Nakara, C. P.1980. Farm machines and equipment. Dhanpat Rai and Sons, New Delhi

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Fundamentals of Internal Combustion Engines by Paul W. Gill, James H. Smith Jr. and Eugene J. Ziurys. Oxford and IBH Publishing Co. Ltd. New Delhi.

Tractors and Their Power Units by J.B. Liljedahl, W.M. Carleton, P.K. Turnquist and D.W. Smith. John Wiley & Sons, New York.

Course Code : SSC 304
Course Title : Introductory Soil Conservation and Watershed Management
Credit Hours : 2(2+0) Full Marks: 50 Theory: 50 Practical: 0

OBJECTIVES

Upon the completion of this course, the students will be able to understand forms of soil erosion and land degradation and the mechanics involved therein to apply control measures for protection and restoration both in general and Nepalese context.

I. SYLLABUS

Introduction: Importance of Soil and Its Conservation, Soil erosion: Causes of Soil Erosion; Mechanics of Soil Erosion by Water; Mechanics of wind erosion; Landslide, Landslip and Mass Wasting; Monitoring and estimation of soil erosion; Soil Erosion Control and Control Measures; Land Use Capability Classification of soil; Soil conservation; Bio-Engineering Techniques; Hydrology; Watershed Management; Present status of Soil Conservation and Watershed Management in Nepal.

III. COURSE OUTLINE

Lectures

S. N.	Topic	No. of Lectures
1.	Introduction: Importance of Soil and Its Conservation	1
2.	Soil erosion: Definition and type of soil erosion, Causes of Soil Erosion	2
3.	Soil Erosion by Water: Mechanics of water Erosion, Water Erosion Types and Factors Affecting, Theory to solve of landslide problem in Nepal.	5
4.	Soil erosion by Wind: Mechanics of wind erosion, Types and Factors affecting Wind Erosion.	3
5.	Soil erosion monitoring and estimation: Simple Visual Methods, Run off plot Technique, Empirical method for soil loss-Universal Soil Loss Equation (USLE)	3
6.	Land Use Capability Classification of soil	2
7.	Soil conservation: Importance of soil conservation, Soil conservation practices on farm land, pasture land, forest land and urban area; Biological and Mechanical methods for Soil Erosion Control; Slope Agriculture Land Technology (SALT)	4
8.	Bio-Engineering Techniques: Introduction and function of Bio engineering measures. Comparison of bio-engineering with conventional approaches	2

9.	Hydrology: Definition, Braches and scope of hydrology, importance of hydrologic knowledge in natural resource planning; Hydrologic cycle, human influence on hydrologic processes	2
10.	Watershed Management: Definition and Concept of Watershed Management, Watershed Management Planning, Integrated Watershed Management, Water Harvesting technique,	4
11.	Present status of Soil Conservation and Watershed Management in Nepal	2
Total		30

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Tripathi, R. P. and H. P. Singh. 1993. Soil Erosion and Conservation. Wiley Eastern Ltd, New Delhi

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FAO soil bulletin 44, 1985. Watershed Management: with reference to soil and water conservation

M. Michael, T. P. Ojha 1978. Principles of Agricultural Engineering Volume II, 2nd Ed.

Peter E. Black 1996. Watershed Hydrology. State University of New York, 2nd Ed.

Conservation Newsletter of the Department of Soil Conservation and Watershed Management, Babarmahal Kathmandu.

Guidelines for Watershed Management. FAO Watershed Management Field Manual, FAO, Rome.

Vegetated and Soil Treatment Measures. FAO Watershed Management Field Manual No. 13/1. FAO, Rome

Course Code : AEN 402

Course Title : Principles and Practices of Farm Water Management

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

OBJECTIVES:

Upon the completion of this course, the student will be able to know basic knowledge and skill on principles and practices of irrigation and drainage, crop water requirement, consumptive use, soil-water-plant relationship, irrigation scheduling, irrigations methods, reclamation of water-logged field, drainage systems, existing farmers' managed irrigation and drainage technologies in Nepal.

I. SYLLABUS:

Introduction to irrigation water resources in Nepal, prevailing irrigation and drainage systems, perspective of irrigation development, irrigation water management; Environmental impacts of irrigation water use, Soil-Water-Plant Relationship; Soil moisture constants, Infiltration, intake, percolation, seepage, permeability, hydraulic conductivity; Soil moisture extraction pattern and critical stages of crops; Evaporation, transpiration, Evapotranspiration (ET), consumptive use; potential evapotranspiration, crop coefficient, Crop water requirements, Irrigation efficiency, irrigation water requirement, Duty of water and Delta; Irrigation water scheduling, depth and frequency of irrigation, deficit irrigation, allowance soil moisture depletion, Soil, plant and climatic indicators for irrigation scheduling, Crop planning; Farm irrigation methods: Surface irrigation method, Sub-surface irrigation method, Overhead: Sprinkler irrigation method, others methods: drip and trickle irrigation method, Advanced technologies in irrigation methods, Performances of irrigation methods; Canals: open channel, Measurement of irrigation water: weir, flumes and orifices, float method; Water control structures, erosion control structures, channel crossing structures, Irrigation pumps: Types of Irrigation pumps: Displacement pumps, Centrifugal pumps, turbine pumps, propeller pumps, airlift pumps, Selection of irrigation pumps; performance of Centrifugal pump, characteristic curves, affinity laws, specific speed; Drainage Engineering: water logging and its effects, Causes of water logging, Land drainage, classification of drains, benefits of drainage, essential requirement of drains, surface drains and closed drains, Land reclamation: saline, alkali soils, saline-alkali soils; formation of saline, alkali soils; farmers' managed irrigation system in Nepal.

II. COURSE OUTLINE

A.Lecture

S. N.	Topics	No. of Lectures
1.	Introduction: Concept of irrigation and drainage water management, objectives, advantages and disadvantages; Introduction to irrigation water resources in Nepal, prevailing irrigation and drainage systems, perspective of irrigation development, Environmental impacts of irrigation water use,	2
2.	Farmers managed irrigation system in Nepal: Introduction to farmers' managed traditional water management system; Introduction to locally available terminologies and methods related to irrigation and drainage water management	1
3.	Soil-Water-Plant Relationship: Classes of soil water; apparent specific gravity; Soil moisture constants; Soil moisture extraction pattern and critical stages of crops for soil moisture; Depth of soil moisture available to plants, Infiltration, Intake, percolation and deep percolation, seepage, permeability, hydraulic conductivity.	3
4.	Potential Evapotranspiration (PET): Concept of evaporation, transpiration, evapotranspiration, consumptive use, potential evapotranspiration, crop coefficient, crop water requirements, Seasonal ET, Actual ET; Estimation of ET by field method (Lysimeters, Evapometers) and empirical method (modified Penman method, Blaney and Criddle method, Christiansen method); Effective rainfall, crop period and base period, command areas and intensity of irrigation, paleo irrigation, kor watering;	3
5.	Water requirements of crops: Determination of crop water requirement- Transpiration ratio method, depth-interval-yield method, soil moisture depletion method; climatological method, field experiment method and drum culture technique for rice; Irrigation water requirement (NIR, FIR, GIR); Duty of water and Delta: and their relations. Factors affecting duty of water	3
6.	Irrigation scheduling: Objectives and strategies of irrigation scheduling, Function of irrigation water, limiting soil moisture conditions; Depth and frequency of irrigation; deficit irrigation; allowance soil moisture depletion; Soil, plant and climatic indicators for irrigation scheduling; Crop planning (continuous, rotational and demand based); Farmers' present practices of irrigation water scheduling.	3

7.	Farm irrigation methods: Surface irrigation method: check basin, border strip, contour lateral, ring basin, furrow, corrugation; Sub-surface irrigation method; Overhead irrigation method- Sprinkler irrigation method; Others irrigation methods; drip, trickle irrigation methods; Performances of irrigation methods- efficiencies, application uniformity, adequacy and effectiveness of irrigation.	5
8.	Open channel and measurement of irrigation water: Introduction to an open channel and solve numerical; Measurement of irrigation water: Float method, current meter, weir, orifices; Parshall flume and Cutthroat flume	3
9.	Canal structures: Water control structures: check gates, turnouts, siphons, division boxes; Erosion control structures open drop structures and pipe drop structures; channel crossing structures- Aqueduct, inverted siphon, culverts.	2
10.	Irrigation pumps: Types of Irrigation pumps: displacement pumps (hand pumps), Centrifugal pumps, turbine pumps, propeller pumps, airlift pumps; Selection of irrigation pumps; performance of centrifugal pump, characteristic curves, affinity laws, specific speed.	2
11.	Drainage System: Introduction; water logging and its effects, Causes of water logging; Land drainage, classification of drains, benefits of drainage; essential requirement of drains; surface drains and closed drains; Land reclamation-definition; saline, alkali soils, saline-alkali soils; formation of saline, alkali soils.	3
Total		30

B. practical

S. N.	Topic	No. of Practicals
1.	Measurement of soil moisture by using: Gravimetric method; Tensiometer; Feel and appearance method; Soil moisture meter	2
2.	Determination of soil moisture constants: Saturation Capacity (SC), Field capacity (FC); Permanent wilting point (PWP), Ultimate wilting (UW)	2
3.	Measurement of infiltration rate of soil: Use of double ring infiltrometer, Single ring infiltrometer; Use of A.N. Kostiakov's formula and determination of its characteristic constants.	2
4.	Determination of evapo-transpiration by using climatic data: Use of Penman's method; Use of Blaney-Criddle method; Using USWB class A pan evapometer, lysimeter	3
5.	Study of different farm irrigation methods: Furrow method, check basin, Sprinkler; Drip irrigation and advanced techniques of irrigation, if any	2
6.	Assessment of field water losses, seepage, percolation and runoff	1
7.	Measurement of flow of water in an open channel by using: Float method; Flow measuring devices: weirs, Parshall flume, cutthroat flume and orifices	2
8.	Field visit to irrigation and drainage systems	1
Total		15

REFERENCES

A.M. Michael. 1997. Irrigation Theory and Practice. Vikas Publishing house Pvt. Ltd. New Delhi.

B.C. Punmia and B.B. Pande. 1990. Irrigation and water Power Engineering. XI Ed. Standard Publishers Distribution, Delhi.

G.N. Shankara Reddi and T. Yellamanda Reddy. 1995. Efficient Use of Irrigation Water. Kalyani Publishers, New Delhi.

P.N. Modi. 2000. Irrigation Water Resources and Water Power Engineering. IV ed, Standard book house, Delhi.

R.K. Sharma and T.K. Sharma. 2002. Irrigation Engineering. S. Chand and Company ltd, New Delhi.

Course Code : AEN 403

Course Title : Farm Structures and Surveying

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 know to prepare and interpret maps/plan and learn about farmstead planning and best construction practices of farm structures.

SYLLABUS

Definitions, classification, units of measurements, scale, conventional signs; chain survey; taping; instruments, taping on level and sloping ground, error, chain/tape triangulation; survey stations and lines, offset, obstacles in chaining; compass survey; types, meridians, angles and direction, bearing, interior angles, prismatic compass, traversing, magnetic declination; leveling: methods, instruments, temporary adjustment, booking and reducing levels, classification, contour, topographic map, land leveling and grading. Construction materials; components of farm structure: foundation shallow and deep, size, walls, floors, roofs, doors, and windows; dampness prevention, plastering, pointing, skirting, RCC, PCC, scaffolding, centering and shuttering; site selection and planning of farmstead; insulation and ventilation in farm buildings; planning and functional requirements of dairy cattle house, poultry house, swine house, design of feed, fodder and grain storage structure and Functional requirements and constructional details of Green House and Poly-House; estimating and costing of farm structures, quantity estimate and rate analysis.

II. Course Breakdown

A. Lecture

S. N.	Topic	No. of Lectures
1.	Introduction: Definition of surveying, classification, units of measurement, scale (graphical and shrunk scale), conventional signs	2
2.	Chain survey: methods of linear measurement (pacing, mileage, recorder, taping), types of chains and tapes, ranging (direct and indirect), chaining on sloping ground, chain triangulation, survey lines, offset, obstacles in chaining, and plotting	4
3.	Compass survey: introduction, meridians, angles and directions, bearing, interior angles, types of compass, use of prismatic compass, traversing, local attraction, and plotting traverse.	3
4.	Definition, objective, principle, Leveling instruments, Temporary adjustment, Methods of leveling; Booking and reducing levels (Height of Instrument and Rise Fall Method)	3
5.	Contour (Introduction, characteristics), Topographic map and its uses	1

6.	Construction materials used in the construction of agricultural structures; bricks, cement, sand, gravel, timber, steel, CGI sheet, thatch, concrete, and Mortar, RCC, PCC, centering and shuttering	3
7.	Components of farm buildings: Foundation, walls, floors, roof, openings (door & windows), beam and column	2
8.	Selection and Planning of Farmstead and thermal insulation and ventilation process and principle in farm buildings.	2
9.	Planning, layout and functional requirements of: Dairy cattle house; Poultry house; Swine house.	4
10.	Sizing and Structural Details of Grain storage; Feed and fodder storage structure: Bag and Bulk Storage Structures, Silo, trench, pit and tower silo; Functional requirements and constructional details of Green House and Poly-House	3
11.	Cost estimation: a. Types and estimate (Approximate and detailed) b. Procedure of preparing detail estimate of agricultural structures. c. Analysis of rate.	3
Total		30

B. Practical

S. N.	Topic	No. of Practicals
1.	Concept of drawings, orthographic projections	1
2.	Planning and layout of dairy cattle, poultry and swine housing	2
3.	Planning and layout of Feed and fodder storage structure and Green House and Poly-House	2
3.	Preparation of detailed quantity and cost estimate of a farm building	2
4.	Working out quantities of materials	1
5.	Working out areas based on: 1) Direct measurement on ground and 2) Drawing measurement applying graphical and instrumental method	2
6.	Chain surveying	1
7.	Surveying of a given plot of land and preparing map at suitable scale	1
8.	Leveling: Instrument handling; profile leveling/longitudinal sectioning	2
9.	Contour map; concept of drawings, orthographic projections	1
Total		15

REFERENCES

C.Punmia, Ashok. Kr. Jain and Arun Kr. Jain. 2005. Higher Surveying. 15th Ed. Laxmi Publications.

S. Kumar. 2008. Building Construction. Standard Publishers and Distributors.

Nepal National Building Code 201, 202, 203, Department of Buildings, Government of Nepal, Kathmandu.

Farm Buildings in Punjab by A.P. Bhatnagar. Punjab Agricultural University Publication
Farm Building Design by Neubaur L.W. Prentice-Hall Ltd. India

Sub : LEE (Learning for Entrepreneurial Experience)
Course code : LEE 401 and LEE 402
Semester : 7th and 8th Credit hour: (0+5) (0+10)

OBJECTIVES:

Upon the completion of this course, the students will be able to design agricultural project for maximizing productivity and profitability.

SYLLABUS:

Identify the area of production, develop the project or business plan, execute the project, record the input-output, marketing of the product, cost- benefit analysis and writing and presentation of final report

Working modality

1. A group of 5-10 students will apply with production area/working area of their own choice at the time of course registration during 7th semester. The appropriate performa will be developed and given to the students at the time of registration.
2. The Performa with working area and name of the students will be sent to respective Department based on their working area and nature of the project. The respective Department will allot supervisor/ mentor for each group within two weeks of course registration. The total number of students registering in each Department must not exceed 33% of total students of the batch.
3. The business plan/ project developed by each group in consultation with supervisor/ mentor will be defended in the respective Department within one month of the course registration.
4. The financial support for the project will be done by the respective Dean office but the student must return money after the end of the project otherwise result will be withheld if the student group do not return the money given for their project.

Evaluation of the LEE

The evaluation of LEE will be jointly carried out by the course incharge (mentor/ supervisor), and external examiner. The student must present their report in a seminar and show the benefit cost analysis of the project. The grading will be based on return of the project, higher the return higher the grade and vice versa. In case, the results/ output are negative due to some uncontrolled situation such as natural calamities, decision on the grade would be made by the concerned team.

Eligibility

The students to get the eligibility for registering the LEE program must have completed (passed) all the course requirements from 1st to 6th semester. The assignment of the LEE program shall be based on interest and merit basis to comply with the maximum number of seat available in each of the offering areas for project.

Organizational set up

There will be a three tire organizational set up especially designed for the purpose of executing Lee program to give the real experience and flavor of an enterprise to the student. Accordingly, the chief of the executive will be the Dean of a given college whereas, managing director will be concerned Head of Department and LEE incharge will be faculty who supervise the group of student taking LEE program. LEE incharge will directly work under Head of the concerned Department.

Note: The details of working procedure (Manual) will be developed by the Dean Office for the efficient management of LEE Program.

