IAAS BULLETIN

Course Catalogue of B.Sc. Agriculture

TRIBHUVAN UNIVERSITY

INSTITUTE OF AGRICULTURE AND ANIMAL SCIENCE
RAMPUR CAMPUS, RAMPUR
CHITWAN, NEPAL

Revised-2011

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Tribhuvan University
Institute of Agriculture and Animal Science
Rampur Campus, Rampur
Chitwan, Nepal

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The Institute of Agriculture and Animal Science, Tribhuvan University reserves the right to make changes in this course catalogue without notice.

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Foreword

The IAAS has been making a continuous effort to provide agriculture education in Nepal since its inception in 1972. In the course of time, different programs started in the past, which have been modified and/or up-graded to attune the role in addressing the pressing needs and priorities of agricultural sector in the country. It is necessary for the institute to effectively carry out its mandate and ensure that its curricula relevant and respond well to the social transformation and national agriculture development. The constant restructuring of syllabi should bear such contents as to enable skill development in operational aspect of agriculture and contribute to productivity. With these objectives, IAAS started its Post-graduate Program from the academic year 1998/99 to produce higher qualified graduates, academicians and researchers. IAAS offers M.Sc. programs in more than 18 departments and Ph.D. in more than 12 departments. IAAS has now emerged as a high potential academic centre for agricultural education and research and is trying to achieve *Academic Excellence in Eco-friendly Tropical to Temperate (Terai to Mountain) Agriculture*. At present, all the B.Sc.Ag., B.V.Sc. & A.H., M.Sc. and Ph.D. courses are offered under semester system. In this endevour, IAAS subject matter committee thoroughly and critically discussed and developed a curriculum to be offered under semester system. Later on, it was put before a curriculum development workshop for a wider participation of consumer agencies, planners, administrators, field-workers in agriculture and farming communities. The recommendation of the workshop was incorporated in the curriculum and then it was put before the Faculty Board of IAAS for further discussion and modifications and finally to recommend it to the Academic Council of the Tribhuvan University for approval. The present Bulletin is the outcome of this whole process. IAAS is committed to effectively carry out its mandate and ensure that its curricula address and respond to the national priority of *Poverty Alleviation through Sustainable Agriculture* in the country.

With the starting of B.Sc. Agriculture program (semester system) beginning from academic year 2002 (i.e, 2059/2060 B.S.) at Rampur, Lamjung and Paklihawa Campuses, the on-going I.Sc. Agriculture programs at Lamjung and Paklihawa Campuses are phased-out. The duration of B.Sc. Agriculture program has been eight semesters (four years) after 10+2 in Science or Agriculture.

This bulletin contains the academic information, rules and regulations for admission requirements and course description. The curriculum development is dynamic and it demands a continuous and strenuous efforts of periodic review and update. Therefore, I appreciate receiving suggestions, comments or criticism from faculty members, students, consumer agencies, planners and field workers in agriculture and rural development to make this curriculum still more meaningful, forward looking and relevant for agricultural development of Nepal.

I would like to thank all the participants involved in the preparation of this bulletin. The Chairpersons and the members of Subject Committees and the Faculty Members of IAAS deserve special thanks and appreciations. Finally, I, highly appreciate and congratulate Prof. Resham B. Thapa, Asst. Dean (Academics) for taking pain in timely refining of the program and bringing out this bulletin in the present shape.

I hope, this bulletin will be for the benefit and guidance of students and teachers of this institute and it will also be useful to all concerned affiliated or private institutes/colleges offering agricultural education in Nepal.

Thanks.

(Prof. Sundar Man Shrestha., Ph.D.)
Dean

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INTRODUCTION

1. Objectives of IAAS

The Institute of Agriculture and Animal Science (IAAS) is one among the five technical institutes under Tribhuvan University, Nepal. The mission of IAAS is to train competent manpower in agriculture and allied disciplines, and to promote research, development and technology dissemination in agriculture. The objectives of IAAS are as follows:

Design and implement educational programs in agriculture in order to obtain an appropriate balance among established and emerging needs of the agricultural sector in Nepal.

Promote excellence in instruction, research and technology dissemination in agriculture.

Develop technically competent agricultural graduates ready to apply the knowledge and skills in technical agriculture, agricultural extension, agricultural education, agribusiness and agricultural and rural development programs.

Encourage and support faculty members and students for research and scholarly activities relevant to the needs of Nepalese agriculture and farmers.

Foster students self-development, commitment and responsibility for the welfare of Nepalese society.

2. History of Development

The Institute of Agriculture and Animal Science (IAAS) began as a School of Agriculture under the Ministry of Agriculture in 1957 to train Junior Technical Assistants (JTAs) in agriculture. In 1968, the school was upgraded to College of Agriculture and a two-year Intermediate of Agricultural Science (I.Sc.Ag.) program was started. In 1972, the College of Agriculture was given the status of the Institute of Agriculture and Animal Science under Tribhuvan University. Until that time, the institute did not have its own buildings and facilities and was operated at *Jagdamba Bhawan* at Pulchok in Kathmandu. In 1974, the institute was relocated from Kathmandu to its present site at Rampur in Chitwan district where 110 hectares of land, buildings and facilities of then Panchayat Training Center were endowed to the institute. Later in 1978, 125 hectares of livestock farm under Ministry of Agriculture was handed over to IAAS for teaching. At present, the institute has three campuses. The Rampur Campus, which is the main Campus located at Rampur, Chitwan district, other two campuses are the Lamjung Campus, located at Sundar Bazar, Lamjung established in 1975 and Paklihawa Campus located at Bhairahawa, Rupandehi district established in 1978. At present, the institute offers a B.Sc. Agriculture (Bachelor of Science in Agriculture), B.V.Sc. & A.H. (Bachelor of Veterinary Science and Animal Husbandry), M.Sc. Agriculture, M.Sc Animal Science and Doctor of Philosophy (Ph.D.) programs at Rampur Campus. The other two campuses offering initial two years of B.Sc. Agriculture course will be running full-fledged B.Sc.Ag. program. The IAAS was started with a few permanent faculty positions in 1972, however, now it implements teaching, research and extension programs through a core of over 150 trained and dedicated faculty members at its campuses.

3. Academic Programs

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

The aim of this program is to train academically competent and practical oriented professional agriculturists. The B.Sc. Agriculture program is eight-semester (four-year) course after I.Sc. (Basic Science) or I.Sc. (Agriculture) or 10+2 (Science). Very recently, elective courses have been replaced by offering other relevant and timely demanded courses including Undergraduate Practicum Assessment (0+3) in the final semester. Field practicals, project works and study visits are part of the academic curriculum. The students must fulfil four years of residential learning to complete the requirements of B.Sc.Ag. curriculum.

Bachelor of Veterinary Science and Animal Husbandry (B.V.Sc. & A.H)

The B.V.Sc. & A.H. program was started at IAAS beginning the academic year of 1993-94 (2050-051 B.S.). The aim of this program is to train skilled and competent manpower in the areas of livestock health, production and management. The regular B.V.Sc. & A.H. program is a five years course after I.Sc. (Basic Science) or I.Sc. (Agriculture) which includes nine semesters of academic courses and a final one semester of internship. The curriculum has been designed to integrate basic, production and management, practical and clinical subjects to impart both extensive and intensive knowledge in veterinary clinical sciences, animal breeding, livestock production and management.

M.Sc. Agriculture/M.Sc. Animal Science/ M.Sc. Aquaculture/M.Sc. Veterinary Science

Master of Science in Agriculture was started in Horticulture, Plant Breeding, Agriculture Economics and Master of Science in Animal Science (Animal Nutrition) beginning academic year of 1998 (2055). The program was expanded to Agronomy, Plant Pathology, Entomology, Plant Protection, Agriculture Extension and Rural Sociology, Fishery and Animal Breeding in 1999, Soil Science in 2000 and Livestock Production and Management in 2002. The M. Sc. Ag. (Environmental Science) and M. Sc. Veterinary Science, and M.Sc. Aquaculture finally was initiated in 2004. Meat Technology and Dairy Technology are planned for the future.

Doctor of Philosophy

Doctor of Philosophy (Ph.D.) program in Horticulture and Animal Nutrition was initiated in the January Session of 2002. The program was further expanded to Plant Breeding, Plant Pathology and Entomology in the July Session of 2003. Later on, PhD Plan-A (Courses and research) and Plan-B (Research) both Programs were expanded in many other departments. At present, the program runs in all the departments except in veterinary and basic sciences.

4. Research Program

The research activities at IAAS are coordinated through the Directorate of Research. Funding support for the research activities includes IAAS own fund as well as external funding by national and international organizations. The research findings are published in the Journal of Institute of Agriculture and Animal Science (J. Inst. Agric. Anim. Sci.) which is an annual publication of IAAS.

5. Extension Program

Extension program was regularly initiated only after the establishment of the Directorate of Extension in 1999. It organizes short courses for farmers, extension and development workers and provides veterinary health services through mobile veterinary health camps. It also provides technical services, seeds, and planting materials to the farmers.

6. Physical Facilities

Classrooms and Laboratories

Two separate building complexes have been developed for B.Sc. Agriculture and B.V.Sc. & A.H. programs, which include classrooms, laboratories and office space for the faculty members. The laboratories are maintained by the respective departments to support practical training prescribed in the courses. The laboratories are equipped with equipment for basic teaching and analytical works. A new laboratory annex has been developed for Postgraduate teaching and research. The facilities of these laboratories are also utilized to support faculty research program.

Student Hostels

There are six students' hostels at the Rampur Campus including one girl's hostel with the total accommodation capacity of over 600 students. The hostels have facilities of common rooms, mess, indoor games and recreation. One P.G. hostel with capacity of 50 students is also in use from July of 2003 at IAAS. Other campuses also have adequate residential facilities for the students.

Library

The IAAS library at Rampur Campus has a two-storied building with the total floor spaces of 19,671 square feet. The library maintains collection of over 32,000 books, journals, monographs, thesis and dissertation, annual reports and bibliographies. At present, the IAAS library subscribes 83 technical journals, bulletins and periodicals. In addition the library also subscribes 24 newspapers and magazines, both national and international. An electronic library with 170 world famous periodicals from 1993 to 96 for postgraduate studies has also been added in the library. The library is open for the students and faculty everyday except on the public holidays. Relatively small number of relevant books and journals are in collection in other two campuses as well.

Veterinary Teaching Hospital

A veterinary teaching hospital with modest facilities has been operating since 2000. It provides clinical services to farm animals at the hospital.

Farms

The Rampur Campus at Rampur maintains four farms – Agronomy farm (51 ha), Horticulture Farm 28 (ha), Livestock Farm 98 ha) and Fish Farm (1.5 ha). These farms support teaching and research requirements and are also used for production purposes. The field plots of Agronomy farm and well laid out with irrigation and drainage facilities and

offers excellent opportunity for research in irrigated and rained conditions. The Livestock Farm maintains local as well as exotic breeds of cattle, buffaloes, sheep, goat, swine and poultry. The Horticultural Farm includes vegetable production block, orchard and space for propagation of fruits and ornamental plants. Green house and screen house facilities have also been developed to a modest level for controlled environment experimentation. The other two campuses also have adequate farm facilities for students' teaching and research.

Computer Center

The Rampur Campus maintains a computer center for faculty, students and staff use. The facilities of the computer center are used for students training, analysis of research data, maintaining administrative database, word-processing and preparation of teaching materials.

Sports and Extra Curricular Activities

The institute has modest facilities for indoor and outdoor sports such as football, volleyball, basketball, badminton, table tennis and lawn tennis. Television sets have been provided in the boys and the girls' hostels for recreation. The IAAS administration as well as students' clubs and union organize events or sports and extra curricular activities from time to time.

Transportation and Communication

Rampur is linked by an all season black topped road to Bharatpur, the headquarter of Chitwan District. Regular public transport is available from Narayanghat and Bharatpur to Rampur. The institute also maintains a pool of vehicles for transportation. There is regular bus service, in the morning and evening up to Narayanghat for the local staff and students. Bus service is also available for students, faculty and staff for marketing at Narayanghat. The Rampur Campus is also linked with telephone, facsimile, internet and electronic mail services available for the students, faculty and staff. The other two campuses also have easy access by road and tele-communication.

Medical and Health Care

The Rampur Campus maintains a dispensary, which provides free medical service to students, faculty and staff and their families. The dispensary has its own furnished building and equipment for minor medical checkup and treatment. Services of medical practitioners are available in other two campuses also.

Post Office

A Post Office operate within the premise of the Rampur Campus, which provide banking and postal services to students, faculty and staff and neighboring communities.

School for Children

A secondary and a primary school are operating at the campus for the children of faculty, staff and students. The campus administration provides some budgetary, manpower and material support for the schools.

7. Admission, Evaluation and Award of Degree

Admission Requirements for B.Sc.Ag. and B.V.Sc. & A.H.

Students with I.Sc. (Basic Science) or I.Sc. (Agriculture) or 10+2 (Science) with compulsory English, Physics, Math, Chemistry and Biology securing a minimum of 50 percent marks in aggregate from Tribhuvan University or from other recognized universities and boards are eligible for admission to B.Sc. Agriculture program. Selection for admission is on a merit basis through an entrance examination.

An Admission Committee formed by the Dean of IAAS within the framework of Tribhuvan University rules and regulations formulates the policies concerning student intake and entrance examination. Girls students and students from disadvantage group are provided some preferences in terms of reserved quota and leverages in admission requirements. However, these are subjected to changes in the lines of national and Tribhuvan University policies. The policies for the admission in B.Sc. Agriculture and B.V.Sc. & A.H. programs are communicated in national media well in advance of the date of entrance examination and admission.

Evaluation and Examination System

Semester System

The institute follows a semester system of education. There are two semesters in each academic year. One semester covers a period of 90 effective working days of teaching and two weeks for final examination.

Evaluation and Examination System

The institute follows semester system of examination for evaluation. A total of 20% of full marks in theory in each subject is evaluated internally through an internal assessment. The student must secure at least 40 percent 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 a valid reason.

The Examination Board of Tribhuvan University conducts a separate final theory examination with 80% of total marks and 100% of practical for each level externally through an external system of examination. A student 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 a Back Paper Examination conducted by the Tribhuvan University Examination Board in each semester after about a month of announcement of final examination result for the previous semester. Such students need not to repeat the course provided they pass the internal assessment and qualify for final examination. Those who fail in the back paper examination should take the regular class along with the regular students of the particular semester.

Attendance Requirements

A student must attend at least 70% of classes in each subject to be eligible for final examination. Failure to meet the minimum attendance requirement may debar a student from

taking final examination. A student must have taken the internal assessment exam to be qualified for the final or the backpaper examination. For only practical course, a student must have attended the practical class as reflected in the attendance register of the course instructor.

Award of Degree and Transcript of Academic Records

A student becomes eligible for the award of degree of B.Sc. Agriculture or B.V.Sc. & A.H. after completion of all the requirements prescribed by the curriculum. No partial degree shall be awarded in case a student fails to complete any of the prescribed requirements. The Controller of Examination of Tribhuvan University issues transcript of Academic Record after the notification of results. The standing of the students is based on aggregate percentage of marks as under:

Distinction	80%
First Division	65%
Second Division	50%
Pass	40%
Fail	less than 40%

8. Students' Welfare

General

The facilities for students' welfare at the IAAS, central campus includes students' hostels, health care and medical facilities and facilities for sports, extra curricular activities and recreation. A member from IAAS faculty is appointed as Extra Curricular Activities Chief to organize and coordinate sports and extra curricular activities. In addition student clubs and cultural groups also organize extra curricular activities from time to time.

Scholarship

The institute provides scholarship to meritorious students. At present 25 percent of the students receive a scholarship of Rs. 200 per month upto maximum of 10 months in each academic year. In addition 20 percent of students are provided with freeship that waives payment of the tuition fees. The award of scholarship is however subjected to change depending upon availability of funds and Tribhuvan University policy.

9. Design and Delivery of Curriculum

The curriculums of B.Sc. Agriculture and B.V.Sc. & A.H. programs include courses in basic and core disciplines and also courses specific to agroclimatic and physiographic settings of Nepal and Nepalese farming systems. The Subject Committees in different areas of agriculture and veterinary sciences propose and design the courses. The content of the courses are critically discussed and modified by the Faculty Board of the institute. The course curriculum is implemented after approval of the Academic Council of Tribhuvan University.

The delivery of courses of B.Sc. Agriculture and B.V.Sc. & A.H. programs at the central campus is carried out through Instructional Departments.

Course Code

The course codes listed in this curriculum have a short text of the subject matter. The digits are read from left to right. The first digit indicates the year in which a course is offered, the second digit indicates the first (1) or the second (2) semester of the academic year and third digit indicates serial number of the course in sequence in the semester offered by an Instructional Department. Each theory or practical credit hour 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 lecture per week, and for practical means two to three hours of practical per week.

Core Courses

The core courses are compulsory subjects offered by different Instructional Departments. All the students of B.Sc.Ag. or B.V.Sc. & A.H. program are required to study and pass the core courses as prescribed in the curriculum.

Elective Courses

Elective courses were designed to provide specialized knowledge and skills in the areas of students' interest. The elective courses of 12 credits from one or more related departments were offered in the fourth year of B.Sc.Agriculture program. The packages of elective courses have now been replaced with cmmon and relevant courses, therefore, elective courses will be offered no more now onwards.

Project Works

Project work in agronomy, horticulture and animal husbandry are integral part of B.Sc.Ag. program. The students are given independent responsibility for crop and vegetable cultivation and rearing of farm animals where they learn and acquire skills on crop and animal husbandry.

Work Experience

This course is designed to inculcate in the students the dignity of work. The students will be required to accomplish various activities related to agriculture, society, sanitation, landscaping, environment protection, etc.

Internship Program

The internship for one semester is integral part of B.V.Sc. & A.H. degree program. The objective of the program is to provide pre-service field training in the areas of veterinary science and animal husbandry.

10. Other Requirements and Rules

The aspects of instruction, evaluation, and other areas of academics not mentioned in here are as per rules and regulations of the Tribhuvan University.

SEMESTERWISE DISTRIBUTION OF COURSES FOR B.Sc.A.g. PROGRAM

SEMESTER 1		**Cr.Hr.**
EXT 111	Rural Sociology	2+0
BCH 111	General Biochemistry	2+1
AEC 111	Principles of Economics	2+0
AGR 111	Principles of Agronomy	2+1
HRT 111	Introductory Horticulture	2+1
SSC 111	Fundamentals of Soil Science and Geology	2+1
LPM 111	Introductory Animal Science	2+1
WEP 111	Work Experience Program	0+1
		14+6

SEMESTER 2		
PPH 121	Introductory Crop Physiology	2+1
MIB 121	Agricultural Microbiology	2+1
AEC 121	Farm Management, Production Economics and Planning	2+1
AGR 121	Cereal Crop Production	2+1
HRT 121	Ornamental Horticulture	2+1
SSC 121	Soil Fertility, Fertilizers and Integrated Nutrient Management	2+1
LPM 121	Ruminant Production	1+1
WEP 121	Work Experience Program	0+1
		13+8

SEMESTER 3		
ECO 211	Environmental Sciences and Agro-Ecology	2+1
AEC 211	Agricultural and Environmental Economics	2+0
AGR 211	Grain Legumes and Oilseed Production	1+1
ENT 211	Introductory Entomology	2+1
HRT 211	Fruit and Plantation Crop Production	2+1
GEN 211	Introductory Genetics	2+1
LPM 211	Pig and Poultry Production	1+1
AMT 211	Introductory Agrometeorology	2+0
AQU 211	Introductory Ichthyology	1+1
		15+7

SEMESTER 4		
AGR 221	Commercial Crops	2+1
AGR 222	Principles and Practices of Seed Technology	2+1
AST 221	Agricultural Statistics	2+1
HRT 221	Vegetable and Spice Crop Production	2+1
PLB 221	Introductory Plant Breeding	2+1
SSC 221	Soil Physics, Genesis and Classification	1+1
AEN 221	Farm Power and Machinery	2+1
ANU 221	Fodder Production and Pasture Management	1+1
AQU 221	Principles of Aquaculture	1+1
		15+9

SEMESTER 5

ECO 311	Medicinal and Aromatic Plants	1+1
EXT 311	Fundamentals of Agricultural Extension	2+1
COM 311	Computer Application	0+1
ENT 311	Principles and Practices of Insect-Pest Management	2+1
HRT 311	Agroforestry	2+1
GEN 311	Genetics of Populations	2+0
PLP 311	Introduction to Plant Pathology	2+1
SSC 311	Introductory Soil Conservation and Watershed Management	2+0
ANU 311	Animal Nutrition and Feeding Practices	1+1
PRW 311	Project Work	0+2
		14+9

SEMESTER 6

AEC 321	Nepalese Agriculture Development and Policy	2+0
EXT 321	Agricultural Communication	2+1
EXT 322	Social Mobilization and Community Development	2+0
ENT 321	Economic Entomology	2+1
HRT 321	Post Harvest Horticulture	2+1
PLP 321	Crop Diseases and their Management	2+1
ANB 321	Principles and Practices of Animal Breeding	2+1
PRW 311	Project Work	0+2
		14+7

SEMESTER 7

AEC 411	Agribusiness Management, Marketing and Cooperatives	2+1
AGR 411	Farming Systems and Sustainable Agriculture	2+1
AGR 412	Organic Agriculture	1+1
AEN 411	Principles and Practices of Farm Water Management	2+1
ANU 411	Mountain Agriculture	1+1
BIT 411	Introductory Biotechnology and Biodiversity	2+0
ECO 411	Agrobiodiversity Management	1+1
ENT 411	Environmental Pollution and Protection	1+0
PRW 311	Project Work	0+2
		12+8

SEMESTER 8

AEC 421	Agriculture Project Planning	2+1
AEC 422	Agri-Business Meanagement	2+0
AEN 421	Farm Structures and Surveying	2+1
HNU 421	Applied Human Nutrition	2+0
LPM 421	Introduction to Dairy Science	2+1
UPA 412	Undergraduate Practicum Assessment	0+3
		10+6

Total: 167 Credit hours

AGRICULTURAL ECONOMICS

Course Code : AEC 111

Course Title : Principles of Economics

Credit Hours : 2 (2+0) Full Marks: 50 Theory: 50 Practical: 00

OBJECTIVES

Upon the completion of this course, the students will be able to understand the general concept and principles of economics, particularly related with production, consumption and distribution.

I. SYLLABUS

Definition of Economics-Adam Smith, Marshall, and Robbins; Subject matter and nature of economics. Basic concepts of economic terms. Consumption and indifference curves and their analysis, price effects and income effects. Law of diminishing marginal utility. Law of demand and elasticity of demand. Law of supply and elasticity of supply. Cost curve concepts and their relationships. Market structure and price determination - market forms; perfect competition market; monopoly market, and monopolistic market. Characteristics and theories of land, labor and capital. Malthusian and optimum theory of population.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Definition of economics – Adam smith, Marshall, and Robins	2
2.	Subject matter and nature of economics	1
3.	Basic concepts – goods, utility, value, wealth, equilibrium, and margin	1
4.	Consumption and indifference curves and their analysis – meaning, types, and properties of consumption and indifference curves	4
5.	Price effect and income effects	1
6.	Law of diminishing marginal utility-meaning, assumptions, limitation, and exceptions	3
7.	Law of demand and elasticity of demand	3
8.	Law of supply and elasticity of supply	1
9.	Cost curves and their relationships	2
10.	Market structure and price determination – market forms, characteristics of perfect competitions market and price determination, characteristics of monopoly market and price determination, characteristics of monopolistic market.	4
11.	Land – characteristics and theories of rent	2
12.	Labor – characteristics and theories of wages, Malthusian and optimum theory of population	3
13.	Capital – characteristics and theories of interest	2
14.	Organization – Meeting, types of organizations and theory of profit	1
	Total:	30

REFERENCES

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

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

Course Code : AEC 121

Course Title : Farm Management, Production Economics and 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 understand the principles, nature, scope and importance of farm management, and farm planning and budgeting tools and techniques.

I. SYLLABUS

Introduction to Farm management – definition, nature, and scope; farm management in relation to other sciences. Farm management and farming systems. Management of farm resources. Production economics; Production relationships – factor-product relationships, factor-factor relationships, product-product relationships. Principles involved in farm management decisions- the principle of diminishing return, cost principle, the principle of substitution, the principle of combining enterprise, The principle of equimarginal returns, the principle of comparative advantages, the principle of time comparison. Tools of farm management – farm planning, techniques of farm planning; Farm budgeting, steps in farm planning and budgeting; introduction to linear programming. Farm business analysis – farm records, accounts, and their types; farm inventory; measuring financial conditions, measuring farm profits; farm prices and production efficiency; factors affecting farm cost and incomes. Risk and uncertainty management.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Introduction to farm management – definition, nature, and scope	2
2.	Farm management in relation to other science, farm management and farming systems	2
3.	Management of farm resources- land management, farm layout, impact of mechanization, soil and nutrient management	3
4.	Production economics and production relationships – factor-product relationships, factor-factor relationships, product-product relationships	4
5.	Principles involved in farm management decisions- the principle of diminishing return, cost principle, the principle of substitution, the principle of combining enterprise, The principle of equimarginal returns, the principle of comparative advantages, the principle of time comparison	4
6.	Farm planning – principles and techniques of farm planning	2
7.	Farm budgeting - partial and complete budgeting, steps in farm planning and budgeting	2
8.	Farm records, accounts, and their types	2
9.	Farm inventory	2
10.	Measuring financial conditions and farm profits	2
11.	Farm prices and production efficiency	2
12.	Factors affecting farm cost and incomes	1
13.	Introduction to linear programming	1
14.	Risk and uncertainty management	1
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Profit maximization with one input	1
2.	Optimum input decision and cost analysis	1
3.	Factor-factor analysis and least cost combinations of resources	1
4.	Product-product relationships and principle of enterprise combinations	1
5.	Appraisal of farm resources	2
6.	Record keeping	1
7.	Preparation of enterprise budget for main crops and livestock	1
8.	Preparation of partial budget	1
9.	Analysis of existing farm plan and preparation of new farm plan	1
10.	Farm business analysis through a detail farm record book keeping	1
11.	Farm efficiency measures – physical efficiency measures, financial efficiency measures, networth statement, income statement	2
12.	Exercise on linear programming	1
13.	Risk and uncertainty management	1
	Total:	15

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

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

Course Code : AEC 211

Course Title : Agricultural and Environmental Economics

Credit Hours : 2 (2+0) Full Marks: 50 Theory: 50 Practical: 00

OBJECTIVES

Upon the completion of this course, the students will be able to understand environmental issues related to agricultural development. They will also learn about the balanced environmental and the agricultural activities towards sustainable development.

I. SYLLABUS

Concept of resources- Categorization of natural resources, Behavioral relationship of bio-mass; Resource base of Nepalese Economy- Population, Land Resources, Forest resources, Water resources, Mineral resources and climatic resources, Livestock resources; Economic analysis of agricultural and related resources- Project Cycle and its use for mitigating the environmental problems, Financial and economic analysis of a agriculture related project; Interrelationship between human and natural resources- Interrelationship between different components of Nepalese farming system, Nutrients cycle, Interrelationship between population and resources depletion; Environmental and agricultural resource management problems- forest and deforestation, soil erosion and pollution, species extinction and degradation of bio-diversity, Watershed degradation, Inland fisheries; Past and present policy of the government in resource management- economic development policy, natural and agricultural resource conservation strategies, environmental economic policies, Nepal's environment policy and action plan, environment in relation to public and private sector development planning, national legislation on protecting resources, Institutions involved in

resource management, environmental impact assessment, environmental amenities, use of limited farm resources for economic management.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Concept of natural resources	1
2.	Behavioral relationship of bio-mass	1
3.	Population and its relationship with resource depletion	2
4.	Land resources, cultivable land and land use trends	2
5.	Forest resources and deforestation	2
6.	Water, Mineral and climatic, and Livestock resources	3
7.	Introduction to project cycle and its use for mitigating environmental problems	2
8.	Financial and economic analysis of a agriculture related project	2
9.	Interrelationship between different components of Nepalese farming system	1
10.	Nutrients cycle	1
11	Watershed degradation, Soil erosion and pollution	2
12.	Species extinction and degradation of bio-diversity	1
13.	Inland fisheries	1
14.	Economic Development Policy	1
15.	Natural and agricultural resource conservation strategies	1
16.	Environmental economic policies and action plan in Nepal	1
17.	Environment in relation to public and private sector development planning	1
18.	National legislation on protecting resources	1
19.	Institutions involved in resource management	1
20.	Environmental impact assessment	1
21.	Environmental amenities on valuation of non-traded goods	1
22.	Use of limited farm resources for economic management	1
	Total:	30

REFERENCES

CBS, 1998. A compendium on environment statistics 1998 Nepal. His Majesty's Government, National Planning Commission Secretariat. Central Bureau of Statistics, Kathmandu, Nepal.

Course Code : AEC 321

Course Title : Nepalese Agriculture Development and Policy

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 the overall agricultural situation of Nepal, and also critically assess the Nepalese agricultural development plans, institutions and policies.

I. SYLLABUS

An overview of Nepalese agriculture and economy; Role of agriculture in Nepalese economy; Major components of agriculture – a critical discussion on food grains, cash crops, horticultural crops, and livestock products; Main problems of agriculture- slow growth of production and productivity; risk and uncertainty; structural, institutional and socio-economic constraints; Agricultural institutions in Nepal- a brief description of major institutions relating to agricultural development. Genesis of agricultural development- history of planned development, agriculture in planned development; Critical evaluation of agricultural development in different plan periods including resource allocation, objectives, and their achievements; Measures and Planning for agricultural development; Land reform and land tenure system; Food security situation analysis; Agricultural Perspective Plan – objectives, strategies, and features; Poverty alleviation. Foreign aid and agricultural development.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	An overview of Nepalese agriculture and economy	1
2.	Role and importance of agriculture in Nepalese economy	1
3.	Major components of Agriculture- a critical discussion on food grains, cash crops, horticultural crops, and livestock products	2
4.	Water resources, water management, plan, policy and performance on water resources of Nepal	2
5.	Main problems of agriculture – slow growth of production and productivity; structural, institutional and socio-economic constraints; risk and uncertainty	3
6.	A brief description of major institutions relating to agricultural development such as ADB/N, Gramin Vikash Bank, co-operatives, research and extension institutions, AIC, NFC, NRB, commercial banks, government offices.	3
7.	Genesis of agricultural development – history of planned development, integrated rural development programs, review of agricultural development	2
8.	A critical evaluation of agricultural development in different plan periods including resource allocation, objectives and their achievements	4
9.	Measures and planning for agricultural development	2
10.	Land reform and land tenure system	1
11.	Food security situation analysis	1
12	Agricultural perspective plan – objectives, strategies, and features	3
13.	Efforts of poverty alleviation In Nepal - review of government efforts, programs, and policies; NGOs activities; INGOs activities.	3
14.	Foreign aid and agricultural development	2
	Total:	30

REFERENCES

Chitrakar, P.L. 1990. Planniing, agriculture and farmers: strategy for Nepal. Published by Mrs. Ganesh Devi Chitrakar,Kahtmandu.

Dahal, M.K. 1993. Future of Nepalese economy. NEFAS publication, Kathmandu.

Sijapati, K.S. 1992. Fundamentals of Nepalese rural economy. Ratna Pustak Bhandar, Kathmandu.

Course Code : AEC 411

Course Title : Agribusiness Management, Marketing and Cooperatives

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 meaning, importance of agribusiness management, and the role of market in agribusiness.

I. SYLLABUS

An introduction to agribusiness management. Basic concepts and definitions of firm, plant, industry and their interrelationships with respect to agricultural production; Agribusiness environment, management systems and processes and managerial decision; Organization and business management functions. Human behavior in organization; Financial management of agribusiness – preparation of financial statements and analysis, agribusiness financing; investment appraisals through use of undiscounted and discounted cash flow organization; Leadership and motivation, economic principles involved in capital acquisition, agribusiness control program and evaluation; Cooperatives- concept, definitions, role, organization, structure, cooperative law and bylaws, developing agriculture cooperatives, cooperative marketing, cooperative farming, Agribusiness marketing – marketing system, marketing efficiency, marketing functions, strategic marketing plan, market planning tools, methods in market research; Consumer behavior and supply chain management; Production planning in agribusiness – planning production and risk management; Problems and prospects of agribusiness in Nepal; Agribusiness development and international trade; Impact of government policies on agribusiness enterprises.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Introduction to agribusiness management – definition, scope and importance; concept of business management	1
2.	Basic concept and definitions of firms, plant, industry and their interrelationships with respect to agricultural production	1
3.	Agribusiness environment, management systems, and managerial decisions	1
4.	Organization and functions in business management	1
5.	Human behavior in organization	2
6.	Preparation of financial statements and analysis, agribusiness financing	2
7.	Investment appraisals through use of discounted and undiscounted cash flow organization	2
8.	Leadership and motivation, economic principles involved in capital acquisition	2
9.	Agribusiness control program and evaluation	2
10.	Cooperatives- concept, definitions, role, organization, structure, cooperative law and bylaws, developing agriculture cooperatives, cooperative marketing, cooperative farming,	3
11.	Agribusiness marketing systems, functions, and efficiency	2
12.	Strategic marketing plan, market planning tool, and marketing research	2
13.	Consumer behavior and Supply chain management	1

14.	Production planning in agribusiness – planning production, risk management	2
15.	Problems and prospects of agribusiness in Nepal	2
16.	Agribusiness development and international trade	2
17.	Impact of government policies on agribusiness enterprises	2
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Organization and management structure in different agro-industries	1
2.	Demand-supply of agribusiness commodities in different agro-industries	1
3.	Marketing/post-harvest practices in different agro-industries	1
4.	Preparation and analysis of balance sheet – A case	1
5.	Preparation and analysis of income statement – A case	1
6.	Performance, problems, and prospects of different agro processing industries- A case analysis	1
7.	Ratio analysis and forecasting techniques	1
8.	Investment appraisals through discounted cash flow measures of project worth	1
9.	Agriculture and cooperative marketing practices in nearby market – A case study	1
10.	Visit to an agribusiness unit for the analysis of problems, performances and prospects – A case study	2
11.	Different case analysis related to agricultural cooperatives	4
	Total:	15

REFERENCES

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

Rhodes, V.J. 1983. The agricultural marketing systems. John, Wiley, and Sons, Inc. Singapore.

Course Code : AEC 412

Course Title : Agri-business Management

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

OBJECTIVES

Upon the completion of this course, the students will be able to understand the meaning, importance of agribusiness development, and efficient marketing.

I. SYLLABUS

An introduction to agribusiness management. Basic concepts and definitions of firm, plant, industry and their interrelationships with respect to agricultural production; Agribusiness environment, management systems and processes and managerial decision; Organization and business management functions. Human behavior in organization; Financial management of agribusiness – preparation of financial statements and analysis, agribusiness financing; investment appraisals through use of undiscounted and discounted cash flow organization;

Leadership and motivation, economic principles involved in capital management, agribusiness control program and evaluation; Cooperatives- concept, definitions, role, organization, structure, cooperative law and bylaws, developing agriculture cooperative farming and marketing, Agribusiness marketing – marketing system, marketing efficiency, marketing functions, strategic marketing plan, market planning tools, methods in market research; Consumer behavior and supply chain management; Production planning in agribusiness–planning production and risk management; Case study of agriculture firm; Problems and prospects of agribusiness in Nepal; Agribusiness development and international trade; Growth model of agribusiness firm; Impact of government policies on agribusiness enterprises.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1	Introduction, definition, scope, concept and importance	2
2	Agribusiness environment, management systems- Firms, plant, industry and their interrelationships; organization and functions & human behavior	3
3	Agribusiness control program and evaluation; financial statements and analysis, Agribusiness financing and economic principles, Investment appraisals through use of discounted and undiscounted cash flow, leadership and motivation	4
4	Agribusiness through the development of cooperatives; definition, concept, role and organization, structure, law and bylaws, agriculture cooperatives, cooperative farming and marketing	4
5	Agribusiness marketing systems; functions and their efficiency, marketing plan, and marketing research	3
6	Production planning in agribusiness; risk management, and case study of agriculture firm	3
7	Demand and supply chain; consumer behavior, supply chain management, ratio analysis and forecasting techniques	3
8	Problems and prospects of agribusiness	2
9	Agribusiness development and trade; national and international trade, agribusiness firm growth model	3
10	National policies on agribusiness development and marketing; government policies, impact of government policies on agribusiness enterprises	3
	Total	30

REFERENCES

Acharya, S. S. and N. L. Agarwal. 1999. Agricultural marketing in India. Oxford and IBH Publishing Co., Pvt. Ltd., India.

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

Poudel, K. L. 2006. Agribusiness management.

Rhodes, V.J. 1983. The agricultural marketing systems. John, Wiley, and Sons, Inc. Singapore.

Course Code : AEC 421

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 understand need based program planning for sustainable research and development, and apply the widely used tools in planning, implementation and monitoring and evaluation.

I. SYLLABUS

Method of planning tool, their utilities and limitations; project cycle - need assessment/ problem identification, different aspect of project preparation, logical framework, project appraisal and implementation, monitoring and evaluation with objectives and indicators; preparation of project concept notes on research and development projects; 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 OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Method of planning tools, their utilities and limitations	2
2.	Need assessment/problem identification	2
3.	Different aspect of project preparation	2
4.	Logical framework	2
5.	Project appraisal and implementation	2
6.	Monitoring and evaluation with objectives and indicators	2
7.	Preparation of project concept notes on research and development projects	3
8.	ZOPP approach in project planning	2
9	Socioeconomic research methods	2
10.	Report contents	3
11.	Presentation and visual display of data	2
12.	Acronyms and footnotes	2
13.	Abstract, summary and conclusions	2
13.	References, appendices and proof reading	2
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Need assessment exercise	1
2.	Project cycle	1
3.	Pre-feasibility and feasibility study of a project	1
4.	Preparation of project concept notes and research project proposal	2
5.	Preparation logical framework for monitoring and supervision	1

6.	Financial and economic analysis of a research and development projects conducting a sample survey, data analysis and interpretation	2
7.	Technical writing	5
		15

REFERENCES

APROSC and John Mellor Associates, Inc. 1995. Nepal Agriculture Perspective Plan, Agriculture Project Service Center and John Mellor Associates, Inc.

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.

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

AGRICULTURAL EXTENSION AND RURAL SOCIOLOGY

Course Code : EXT 111
Course Title : Rural Sociology
Credit Hours : 2 (2+0) Full Marks: 50 Theory: 50 Practical: 00

OBJECTIVES
The main objective of this course is to develop students' understanding of 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, contributions 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 behavioral change, social festivals, rituals and social heritage and their relationship to social change and development.

II. COURSE OUTLINE
A. Lectures

S.N.	Topic	No. of Lectures
1.	Sociology: Meaning, nature, and scope and other social sciences	2
2.	Rural Sociology: Meaning, nature, and scope - Development of Rural Sociology as a major field of sociology	1 1
3.	Rural – urban continuum	1
4.	Social movement: meaning and causes of social movement, types of social movement	2
5.	Social process (process of social interaction): Accommodation, adjustment, amalgamation, assimilation, cooperation, consensus, competition, conflict, integration.	2
6.	Social stratification in Rural Nepal: meaning, bases (class, caste, age, gender)	1
7.	Ethnic groups: identification of major races, major ethnic groups, ethnocentrism, inter-ethnic relationships	2
8.	Culture and customs in Rural Nepal: Caste-based norms (folkways, mores), value and belief systems Tribal communities and their cultural identities	3
9.	Common social ceremonies	1
10.	Rural-social institutions: (a) Social institutions: Household, Family & its types - Marriage systems (b) Economic institutions: Farming, fishing, hunting (c) Exchange labor, child labor, labor exploitation (d) Political institutions: (e) Religious institutions: Types of religion, their maintenance and followers	6

11.	Major festivals of Nepal: *Bijaya Dashami, Deepawali (Tihar), Chhat Parba, Lhosar, Shivaratri, Haritalika (Teej), Iid*	1
12.	Social problems and solutions	1
13.	Socialization: Meaning, stages and agents of socialization	2
14.	Social change; meaning, factors of social change	1
15.	Groups: meaning and types of groups	1
16.	Social system: meaning and elements of social system	1
17.	Social deviance and social control; meaning, types, mechanisms	1
	Total:	30

REFERENCES

Bhushan, V. and D.R. Sachdeva. 1994. An introduction to sociology. Kitab Mahal, Allahabad, India.

Chitambar, J.B. 1973. Introductory rural sociology. Wiley Eastern Limited, India.

Regmi, R.R. 2001. The essentials of sociology. Published by Sandeep Raj Regmi, Kath.

Course Code : EXT 311

Course Title : Fundamentals of Agricultural Extension

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

OBJECTIVES

The main objective of this course is to develop students ability to describe the basic concepts of different types and forms of education, their philosophy, principles, objectives processes and practices. This course will also help to develop students' understanding and ability to apply the knowledge of agriculture extension system.

I. SYLLABUS

Concepts and meaning of education types, forms and their characteristics, learning principles, process and methods derived from psychology of education and their application to agriculture extension education: Historical perspective of agricultural extension, philosophy, principles, characteristics and scope. Extension teaching methods, program areas of agriculture extension general concepts, types and process of extension programs, their characteristics and principles, levels of planning and planning approaches and programming cycles: identification of local leadership in extension programming.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Concepts and definition of education, types and forms of education	2
2.	Formal and non-formal education, extension education and agricultural extension education, their nature and characteristics	1
3.	Historical perspective of agricultural extension, its development; philosophy, principles and characteristics	1
4.	Scope, roles and responsibilities of agriculture extension education in agricultural and rural development	2
5.	Fundamental concepts of educational psychology of teaching and learning theories, principles and process of teaching learning	2

6.	Laws of learning, elements of effective teaching and learning	1
7.	Methods of extension teaching individuals, group and mass media	3
8.	Concepts of agricultural technology, adoption and diffusion, agriculture extension and professionals roles and responsibilities as main actors	1
9.	Basic conceptual and process models of adoption diffusion and innovation decision process	1
10.	Characteristics of agriculture technology and technology transfer process the major function of agriculture extension	1
11.	Basic concepts of leader and leadership and their types, roles and responsibilities in the rural aggression communities	2
12.	Identification, selection and development of local leaders, their utilization and maintenance through organized community groups and in general	2
13.	Roles and relationships of local leaders and extension workers in promising agricultural development programs	1
14.	Basic concepts, meaning philosophy of program, planning and program planning process, scope and characteristics of extension programs	2
15.	Participatory and decentralized program planning in agricultural extension and organizational structure and extension delivery systems of the MOAC/DOA DLS	
16.	Types and levels of planning their objectives, and planning cycle	1
17.	Sharing and linkage, partnerships an emerging concept in agriculture development and the Extension services of DOA and DLS	2
18.	Linkages and utilization of other actors of development in providing support services to agricultural development by the ADO/DLS at the grassroots level	2
19.	Basic concepts of evaluation and monitoring of extension programs-approaches, techniques and methods.	2
20.	Utilization of local leadership, community groups and other support groups in extension program evaluation	1
	Total:	30

B. Practical

S.N.	Topic	No. of Lectures
1.	Preparation of individual farm level production plan in (i) crop production (ii) Livestock production (simulated)	2
2.	Interaction meeting/visits with ADO, DLS, ADB, and DDC and study their planning process and plan of work and calendar of operation and organizational mechanism.	4
3.	Interaction meeting/visits with an NGO, and its local group and study their planning process, plan of work and implementation	2
4.	Observation of ASC of ADO and DLS at the grass root level during their planning meeting	4
5.	Preparation of a general community level plan of production in field crop, fruits/vegetables and Livestock production (selective and simulated)	2
6.	Visits/interaction meeting with a community group formed by ADO for extension program	1
	Total:	15

REFERENCES

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

Bhatnagar, O.P. and O.P. Dahama. 1998. Education and Communication for Development. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

Kelsey, C.C., L. David and C.C. Hearne. 1967. Cooperative Extension Work. Comstock Publishing Association, Ithaca, New York.

Course Code : EXT 321

Course Title : Agricultural Communication

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

OBJECTIVES

After the completion of this course, student will be able to select and apply different communication process models, channel and media to make communication effective in the agriculture extension program. They will also be able to prepare communication materials and use them effectively in their field of work.

I. SYLLABUS

Communication-definition, meaning, scope, process and its functions, feedback process, effects in communication, role of feedback in extension education; forms of communication; communication- barriers and noise in communication channel, models and theories of communication; system concept in communication- type of communication, individual, group and mass communication system, role of press, Radio and Television; Communication approaches, and considerations in programs of the world, South-East Asia and SAARC; Planning for Effective communication-role of change agents development communicators, present trends, issues and problems; Communication approaches in agriculture extension programs of Nepal – their achievements and limitations; Role and functions of non-governmental private organizations, agencies involved in communications of agriculture development programs in Nepal.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Communication-definition, meaning, scope, process and its functions	2
2.	Feedback in communication-process, effect; information and feedback in extension education	2
3.	Forms of communication-Verbal and non-verbal	2
4.	Barriers of Communication-Physical, psychological, social and cultural	2
5.	Models and theories of communications	4
6.	System concept in communication-type of communication, their advantages, disadvantages, limitations, individual group and mass communication system	6
7.	Communication approaches-communication considerations involved in developing successful projects/programs in the world, South-East Asia and SAARC	6
8.	Planning for effective communication-trends, issues and problems	2

9.	Communication approaches in agricultural extension programs of Nepal, their achievements and limitations	2
10.	Communication strategies applied through Private, Governmental and Non-governmental organizations at present in agricultural development in Nepal.	2
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Preparation of Graphs–Line, Bar, Pie and Pictorial graphs	2
2.	Preparation of various type of charts-Flow chart, outline chart, tree or stream chart, Flip chart etc.	2
3.	Preparation of Pamphlet and leaflets and folders	1
4.	Preparation of Poster, booklet and pictorial book	1
5.	Preparation of Radio script	1
6.	Preparation of one act drama and folk song	1
7.	Communication through Bulletin, Flannel and Magnetic boards	1
8.	Observation and participation in fair, exhibition & field day and field tour	2
9.	Observation and safe use of overhead, opaque, slide and film projector	2
10.	Visit to different agricultural agencies and study their communication strategies implication of communication approaches currently in use in farming community at Chitwan with the help of agriculture service center and sub-centers.	2
	Total:	15

REFERENCES

Dahama, O. P. and O. P. Bhatnagar. 1999. Education and communication for development, Oxford and IBH Publishing Pvt. Ltd. Calcutta.

Kumar, A. 1999. The mass communication. Amul Publishing Pvt. Ltd. New Delhi.

Ray, G.L. 1998. Extension communication and management. Naya Prakashan Bidden Saran, Calcutta.

Course Code : EXT 322

Course Title : Social Mobilization and Community Development

Credit Hours : 2 (2+0) Full Marks: 50 Theory: 50 Practical: 00

OBJECTIVES

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

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 currents 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 grass root levels, an over view of gender concepts over time, issues, and strategies in developmental activities, gender sensitive development planning.

II. COURSE OUTLINE

Lectures

S.N.	Topic	No. of Lectures
1.	Concept of development, sustainable development, rural and community development, a brief overview of efforts and approaches of rural development in Nepal over the last decades	3
2.	Modernization, modern society, relative deprivation, and human poverty	2
3.	Factors and goals of development, cultural and social heritage and dilemma in the rural development of Nepal	2
4.	Major problems and issues of rural and community development in Nepal.	2
5.	Poverty and poverty alleviation, poverty in SAARC countries, SAARC Declaration on Poverty Elimination	2
6.	Concept of social mobilization, definition, purposes, strategy of implementing social mobilization	2
7	History of social mobilization in Nepal, lessons learned.	2
8	Decentralization for development, definition, strategy and current status of decentralization in Nepal.	2
9	Processes of social mobilization, institutional development, participatory planning, implementation monitoring and evaluation.	3
10	Actors of rural development and poverty alleviation programs, linkages and coordination, problems and issues.	3
11	Introduction to gender concepts, gender segregation and stratification, discrimination and equity.	1
12	Gender needs, roles, analysis, gender sensitive planning gender mainstreaming in development in general and poverty in particular with specific focus at the resource poor women.	2
13	Origin and concepts of WID, WAD, and GAD.	1
14	Gender issues and policies for sectoral programs for targeted and untargeted beneficiaries, holistic approach Vs isolated approach.	2
15	An overview interrelationships of migration, gender situation, and poverty reduction through social mobilization in the rural communities	1
	Total:	30

REFERENCES

Khan, S. S. and J. S. Sah. 2001. Social mobilisation manual based on Syangja Experience, Social Mobilisation Experimentation and Learning Centre.

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

AGRICULTURAL STATISTICS

Course Code : AST 221

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 use different statistical tools in designing experiments, data analysis and report preparation.

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. Lectures

S.N.	Topic	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, Ogives (cumulative frequency curves).	2
5.	Measures of dispersion, Range, Quartile deviation, Mean Deviation, Standard Deviation and Variance, Coefficient of variation. Moments – raw moments and central moments for grouped and ungrouped data relationship between raw moments and central 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, correlation coefficient for bivariate frequency distribution.	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, Randomisation, 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
	Total:	30

B. Practicals

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.	Moments for grouped and ungrouped data; 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 for bivariate frequency distribution 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

REFERENCES

Agrawal, B.L. 1996. Basic statistics (3rd edition), New Age International Pvt. Ltd. New Delhi.

Chandel, S.R.S. 1984. A hand book of agricultural statistics, Achal Prakashan Mandir, Kanpur, India.

Gupta, S.C. and V.K. Kapoor. 1988. Fundamentals of applied statistics, Chand and Com. New Delhi.

Singh, S. and R.P.S. Verma. 1982. Agricultural statistics, Rama Publishers Meerut.

Tripathi, P.N. 1991. A Manual on introductory agricultural statistics, Tribhuvan University, IAAS, Chitwan, Nepal.

Course Code : COM 311

Course Title : Computer Application

Credit Hours : 1 (0+1) Full Marks: 25 Theory: 0 Practical: 25

OBJECTIVES

Upon the completion of this course, the students will be able to use computer for handling and processing of data as well as the words.

COURSE OUTLINE

Practicals

S.N.	Topic	No. of Practicals
1.	Introduction to personal computer and its peripherals	1
2.	Operating systems (DOS and Windows)	2
3.	Execution of data analysis software package	4
4.	Straight line, frequency table, Bar diagram and Pie chart	2
5.	Statistical computation: Mean, Median, Standard deviation, Correlation regression, *t*-test	2
6.	Statistical computation: χ^2-test, CRD, RCBD, LS and factorial	3
7.	Simple data based file creation and query for agricultural sciences	1
	Total:	15

REFERENCES

Kalicharan, N. 2001. An introduction to Computer Studies. Cambridge University Press.

Taxali, R.K. 2001. Software Made Simple. Tata McGraw Hill Publishing Company Limited.

AGRONOMY

Course Code : AGR 111
Course Title : Principles of Agronomy
Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES

This course is designed to provide the students about basic concept, skills and knowledge of principles and practices of Agronomy.

I. SYLLABUS

An overview of agriculture and agronomy; crop classification; crop production; tillage; seed; crop rotation; cropping patterns; cropping and farming systems; selection of crops to be included in crop rotation; sustainable agriculture; concept of ideal plant type and crop yield; crop density, optimum plant population, and crop geometry; soil fertility and productivity; various agronomical practices to be adopted in soil fertility and soil productivity maintenance; crop nutrition; role of fertilizers and manures; organic and green manures and biofertilizers; weed management; losses caused by weeds; weed control methods; plant and soil water relationship; importance of irrigation to crops; drainage and drainage systems; soil erosion and its effects; rainfed farming and water harvesting techniques; recent advances in agronomy.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Definition of Agriculture and Agronomy; Its relationship with other disciplines	3
2.	Definition of weather and climate, Effect of climatic factors, Macro and Micro on crop production	3
3.	Definition and objectives of tillage, Primary and secondary tillage, minimum-tillage	2
4.	Definition of seed, seed quality, germination, dormancy and seed certification	3
5.	Definition of crop-rotation and its principles, cropping pattern, cropping system, mixed-cropping inter-cropping, multiple-cropping, relay-cropping, crop intensity, cropping index; harvest index; land equivalent ratio, economical and biological yield	2
6.	Concept of ideal plant type and crop yield, crop density, optimum plant population, crop geometry and their importance	1
7.	Definition of soil fertility and soil productivity; various agronomical practices to be adopted in soil fertility and soil productivity maintenance	2
8.	Introduction of crop nutrition, role of manures and fertilizers, their types, nutrient contents, factors affecting fertilizers use, time and methods of their application, uses and limitations of organic manures, green manures and biofertilizers	4
9.	Weed management, definition, losses caused by weeds, advantages and disadvantages of weeds, types of weeds, mode of weed seed dispersal. Weed control practices: Prevention, control methods, and eradication with their relative merits and demerits.	3

10.	Principles of plant-soil-water relationship, importance of irrigation to crops, systems and methods of irrigation, irrigation scheduling	2
11.	Principles and objectives of drainage and drainage systems, methods of improving soil drainage system, deleterious effect of ill drained soils.	2
12.	Soil erosion and its bad effects, factors affecting and various soil conservation practices	2
13.	Rainfed farming and water harvesting technology	1
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Identification of crops' seed, fertilizers and manures, herbicides, fungicides and insecticides	2
2.	Identification and uses of various agrometeorological devices	1
3.	Practices on calculation of rates of fertilizers and manures based on their availability and nutrient contents	2
4.	Practices on seed rate calculation of some field crops based on their purity and germination percentage	1
5.	Seed bed preparation for raising seedlings of some agronomical crops like rice, finger millets and tobacco	1
6.	Land preparation for sowing of some seasonal crops	1
7.	Identification of some common weeds and manual weed control in some seasonal crops	1
8.	Practices on compost making by pit and heap method of composting	1
9.	Practices on calculation of some pesticides	1
10.	Preparation of cropping scheme and calculation of cropping intensity of 1-3 years crop rotation program	1
11.	Seed treatment practices with fungicides on seeds and planting materials like wheat, rice, maize, potato tubers and sugarcane sets	1
12.	Visit of IAAS Agronomy Farm and study on on-going research projects of the season.	1
13.	Visit of IAAS workshop and study of various agricultural tools and implements used for different farm operation	1
	Total:	15

REFERENCES

Gupta, O.P. 1993. Weed Management Principles and Practices. Agro. Botanical Pub., Bekaner.

Kipps, M.S. 1970. Production of Field crops. Tata Mc Graw-Hill Publishing Co. Ltd. Bombay and New Delhi.

Martin, J.H., W.H. Leonard and D.L. Slamp. 1976. Principles of Field Crop Production. Macmillan Publishing Co. Inc. New York and Collier Macmillan Canada, Ltd.

Reddy, T.Y. and G.H.C. Reddy. 1994. Principles of Agronomy. Kalyani Publishers, New Delhi.

Course Code : AGR 121

Course Title : Cereal Crop Production

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

OBJECTIVES

This course is designed to develop knowledge and skill about improved agronomical practices of cereal crop production.

I. SYLLABUS

Importance, Origin and History, Distribution, soil and climatic requirements, improved cultural practices, land preparation, manures and fertilizers application, recommended varieties, seeds and sowing, intercultural operation, water and weed management, harvesting, threshing, storage, current status of research and yield and constraints and opportunities of the following cereal crops: rice, wheat, maize, barley, triticale, buckwheat, fingermillet and sorghum.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Importance, Origin and History, Distribution, soil and climatic requirements, improved cultural practices, land preparation, manures and fertilizers rate, time and methods of their application, recommended varieties, seed treatments, seed rate, sowing time, sowing methods, nursery raising methods, spacing, intercultural operation, water and weed management practices, maturity judging, harvesting, threshing, cleaning, drying and storage; current status of research, yield and constraints and opportunities in the following crops	
	Rice	8
	Wheat	7
	Maize	6
	Barley	2
	Buckwheat	2
	Fingermillet	3
2.	Introduction to Triticale.	2
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Field preparation for raising rice and finger millets nursery	1
2.	Raising of rice and finger millet seedlings on rice finger millet nursery	1
3.	Field preparation for rice transplanting and planting of finger millets	1
4.	Field preparation and sowing of wheat, maize, barley and buckwheat by different methods of seeding	3
5.	Seed and seed material treatments with fungicides by different methods	1
6.	Manual interculture operation practices on cereal crops grown during the season	1

7.	Top dressing practices with nitrogenous fertilizers on cereal crops grown during the season	1
8.	Study of yield attributing characters and sign of maturity of cereal crops grown during the season	1
9.	Weed identification of various cereal crops grown during the season	1
10.	Yield estimation and harvesting of cereal crops grown during the season	1
11.	Practices on numerical exercises of seed and fertilizers requirements of cereal crops	1
12.	Visit and study of various researches conducted at research sites of IAAS, Agronomy Farm on cereal crops	1
13.	Visit and study of various researches conducted at research sites of National Maize Research Program	1
	Total:	15

REFERENCES

De Dutta, S.K. 1981. Principles and Practices of Rice Production. John Wiley and Sons, New York.

Singh, C. 1989. Modern Techniques of Raising Field Crops. Oxford and IBH Pub. Co. Pvt. Ltd. New Delhi, Bombay and Calcutta.

Thakur, C. 1979. Scientific Crop Production. Vol. 1 and 2. Metropolitan Book Co. Pvt. Ltd., New Delhi.

Course Code : AGR 211

Course Title : Grain Legumes and Oilseed Production

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

OBJECTIVES

This course is designed to develop knowledge and skills about improved package of practices of grain legumes and oilseed crops.

I. SYLLABUS

Importance, origin, history, distribution, soil and climatic requirements, improved cultural practices, land preparation, manure and fertilizer application, recommended varieties, seed and sowing, weed and water management, harvesting, threshing, storage, current status of research and yield with reference to Nepal of following grain legumes and oilseed crops: lentil, chickpeas, pigeon pea, black gram, green gram, soybean and cow pea. rape seed and mustard, groundnut, sunflower, sesamum and linseed.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Importance, origin, history and distribution, soil and climatic requirement, land preparation and improved culture practices, manures and fertilizer application, seed and sowing, recommended varieties, weed and water management, harvesting, threshing, yield, storage and current status of research of:	
	Lentil	2

Chickpea	2
Pigeon pea	1
Black gram	1
Green gram	1
Soybean	2
Rape and mustard	2
Groundnut	2
Sunflower	1
Sesamum	1
Total:	15

B. Practicals

S.N.	Topic	No. of Practicals
1.	Field preparation for different grain legumes	2
2.	Oilseed crops grown at IAAS agronomy farm	2
3.	Identification of seeds of grain legumes and oilseed crops	2
4.	Seed treatment of oilseed crops	2
5.	Seed germination and purity test	1
6.	Calculation of seed rate at different purity, germination	2
7.	Sowing of some oilseed and grain legumes	2
8.	Study of root nodules and nodulation behavior of some grain legumes	2
	Total:	15

REFERENCES

Rafhore, P.S. 1999. Techniques and Management of Field Crop Production. Agrobios (India), Chopasani Road, Jodhpur, 342003.

Singh, C. 1999. Modern Techniques of Raising Field Crops. Oxford and IBH Pub. Co. Pvt. Ltd. New Delhi, Bombay and Calcutta.

Thakur, C. 1979. Scientific Crop Production. Vol. 1 and 2. Metropolitan Book Co. Pvt. Ltd., New Delhi.

Course Code : AGR 221

Course Title : Commercial Crops

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

OBJECTIVES

The main objective of this course is to provide students the knowledge and skill about improved agronomical practices of commercial, or cash crop production.

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, sugar beet, Fiber crops-jute and cotton, narcotic crops-tobacco, Tuber crops-potato and sweet potato.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Economic importance, distribution, history, origin, soil and climatic requirements, improved cultural practices: land preparation, crop rotation, seed and sowing: seed preparation, time and method of sowing, seed rate and spacing, recommended varieties, manure and fertilizer application, inter-cultural operation, water and weed management, harvesting and recent developments in the following crops.	
	Cotton	6
	Jute	6
	Tobacco	6
	Sugarcane	6
	Sugarbeet	6
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Cultivation of cotton, jute, sugarcane, sweet potato, and potato	1
2.	Branching and flowering in cotton	1
3.	Classification and morphological characteristics of cotton	1
4.	Characteristics of cotton species	1
5.	Classification and morphological characteristics of jute	1
6.	Difference between two species of jute	1
7.	Classification and morphological characteristics of tobacco	1
8.	Difference between two species of tobacco	1
9.	Raising tobacco seedlings and their transplantation	1
10.	Classification and morphological characteristics of sugarcane	1
11.	Calculation of seed cane fertilizers, and yield estimation in commercial crops	1
12.	Calculation of sugar recovery and commercial canesugar	1
13.	Classification and morphological characteristics of potato	1
14.	Morphology of potato tuber	1
15.	Statistical analysis of crop yields in RCBD	1
	Total:	15

REFERENCES

Akehurst, B. C. 1981.Tobacco. Longman Inc., New York.

Kundu B.C., K.C. Basak, P.B.Sarcar. 1959. Jute in India. N.K. Gosian and Co. Pvt. Ltd., Calcutta.

Martin J.H., W.H. Leonard , D. L. Stamp. 1976. Principles of Field Crop Production. Third edition. Macmillan Publishing Co. Inc., New York.

Singh C. 1997. Modern Techniques of Raising Field Crops. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Course Code : AGR 222

Course Title : Principles and Practices of Seed Technology

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

OBJECTIVES

This course is designed to provide students the knowledge, skill and basic concept of seed and seed production technology.

I. SYLLABUS

Seed an object, Seed production as a science and technology, Seed, fruit and grain; seed formation and development process and factors affecting it; seed dormancy; germination and vigor; seed quality and factors affecting it; types of seed, and their development; multiplication, certification, and distribution; international and national organizations involved in seed science and technology; seed production systems in Nepal and national seed laws.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Introduction to the course and the seed as an object	1
2.	Fruits, grains, seeds and seed materials	1
3.	Seed formation, development and growth	1
4.	Factors affecting seed growth and development	1
5.	Seed dormancy and factors affecting it	1
6.	Breaking seed dormancy	1
7.	Seed germination	1
8.	Factors affecting seed germination	1
9.	Seed vigor and crop establishment	1
10.	Seed quality and quality seeds	1
11.	Types of seed and their production	1
12.	Harvesting and threshing	1
13.	Seed cleaning, drying and storage	2
14.	Basic principles of seed production of various crops	1
15.	Seed production of rice and wheat	1
16.	Seed production of maize	1
17.	Seed production of various legume crops	1
18.	Seed production of oil seeds	1
19.	Seed production of industrial crops (cotton and sugarcane)	1
20.	Seed production of vegetatively propagated agronomical crops	2
22.	Seed certification	1
24.	Seed distribution system in Nepal	1
25	Vegetable seed technology	4
25.	ISTA and National seed laws and regulations	1
26.	Farmer, seed and intellectual property right	1
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Identification of seeds of various field crops	1
2.	Measurements of agronomical characteristics of the crop seeds	1
3.	Study of the differences in agronomical characteristics of different varieties of:	
	Rice	1
	Maize	1
	Wheat	1
	Oil seeds	1
	Potato	1
	Others	2
4.	Seed purity test	1
5.	Seed viability test	1
6.	Seed germination test in lab and in the field of certain seeds	1
7.	Seed vigor test	1
8.	Methods preparation of seeds for planting	1
9.	Visit to the seed multiplication farms of NGLP and NMRP	1
	Total:	15

REFERENCES

Agrawal, R.L. 1999. Seed Technology. 2nd Edition. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

Copeland, L.O. and M.B. McDonald. 1985. Principles of Seed Science and Tichnology. 2nd Edition. Macmillan Publication Company. 866 Third Avenue, New York.

Justice, O.L. and N.B. Louis. 1978. Principles and Practices of Seed Storage. Agric. Hand Book No. 506. Science and Education Administration's Federal Res. Staff. Washington D.C.

Course Code : AGR 411

Course Title : Farming System and Sustainable Agriculture

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

OBJECTIVES

This course will enable students to understand basics of farming systems from systems perspectives. Students will also be able to gain knowledge on sustainable agriculture development.

I. SYLLABUS

Introduction, system and systems approach in agriculture, concept of agriculture and farming system. Determinants of farming systems with special reference to Nepal. Climatic factors, edaphic factors, biological factors, socioeconomic factors. Farming system in Nepal; agriecological zones of Nepal, components and resource base of major farming systems, farming system research; historical background of FSR, conventional research Vs. FSR, FSR methodology - diagnostic and design phases, testing, technology transfer and evaluation phases. Sustainable agriculture: agriculture sustainability - a discourse, concept of sustainable agriculture, ancient agriculture and sustainability, agriculture and environment, agriculture

and natural resources, approaches towards sustainable agriculture. Keys to sustainable agriculture - ecological principles, ecological practices, use of inorganic fertilizers, manures and compost, organic farming and biofertilizers. Biodiversity and sustainable agriculture - biodiversity status in Nepal, use of biodiversity in agriculture, management of agro-biodiversity. Indigenous knowledge and sustainable agriculture - farmers' knowledge in managing the farming system, sustainable agriculture and rural development.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
A. Farming System:		
1.	Introduction to the course	
	System and systems approach in agriculture	1
	Concept of agricultural systems and farming system	1
2.	Determinants of farming systems in the hills and the lowlands of Nepal	
	Climatic factors (ecology)	1
	Edaphic factors (soil and land use)	1
	Biological factors	1
	Socioeconomic factors	1
3.	Hill and lowland farming systems in Nepal	
	Agroecological zones in Nepal	1
	Components and resource base of major farming systems	1
	Limitations and opportunities of different farming systems	1
4.	Farming System Research (FSR)	
	Historical background of FSR	1
	Conventional research vs. FSR	1
	FSR Methodology - diagnostic and design phases	1
	Testing, technology transfer and evaluation phases	1
B. Sustainable Agriculture		
1.	Agricultural sustainability- a discourse	
	The concept of sustainable agriculture	1
	Ancient agriculture and sustainability	1
	Agriculture and environment (HEIA)	1
	Agriculture and natural resources (LEIA)	1
	Approaches towards sustainable agriculture	1
2.	Keys to sustainable agriculture	
	Ecological principles	1
	Ecological practices/implications	1
	Use of inorganic fertilizers, manures and composts	2
	Organic farming and biofertilizers	1
3.	Dryland and rainfed farming	5
4.	Indigenous knowledge & sustainable agriculture	
	Farmers' knowledge in managing the farming system	1
	Sustainable agriculture and rural development	1
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	An analysis of farming system: concept and approach and terminologies	2
2.	Farming system research methodology	1
3.	Practice on problem diagnosis methods	1
4.	RRA and PRA: theoretical background	1
5.	Time line and ethno history	1
6.	Resource mapping and seasonality analysis	1
7.	Preference and wealth ranking	1
8.	Transect walk	1
9.	Presentation of the seminar on the used PRA tools	1
10.	Sustainability analysis: concept and approach	1
11.	Practice on the design and experimentation on organic/mixed farming	1
12.	Assessment of the level of biodiversity used by the farmers	1
13.	Comparison of different farming systems of different localities in Nepal	1
	Total:	15

REFERENCES

Chitrakar, P.L. 1990. Planning, agriculture and farmers: strategies for Nepal. Publisher: Mrs. Ganesh Devi Chitrakar, Kathmandu, Nepal.

Doulas, G.K. 1984. Agricultural sustainability in a changing world order. West view press, Boulder, Colorado.

FAO. 1989. Farming system development: concepts, methods and applications, FAO, Rome,

Neupane, F.P. and R.C. Sharma. 1994. Farming systems research and extension in Nepal. Institute of Agriculture and Animal Science, TU, Kathmandu, Nepal.

Course Code : PRW 311

Course Title : Project Work

Credit Hours : 2 (0+2) Full Marks: 50 Theory: 00 Practical: 50

OBJECTIVES

The course will develop skill and confidence in basic cultural practices of major agronomic crops.

I. SYLLABUS

Crop production from seeding to marketing by students themselves. The students are required to prepare the proposal of crop production, execute the proposal and write up report independently and present orally the report to the Course Supervisor.

Course Code : AGR 411

Course Title : Organic Agriculture

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

OBJECTIVES

Upon completion of this course students will be able to understand importance and practical relevance of organic farming along with its theoretical basis as well practical know-how.

I. SYLLABUS

Definition, aim, scope and research trend; green revolution and consequences, food production and security; principles and components of organic farming; livestock integration, indigenous knowledge, organic soil, crop, pest management and marketing of organic produce.

II. COURSE OUTLINE

A. Lectures

S.N.	**Topic**	**No. of Lectures**
1	Definition, concept and scope of organic farming, status of organic farming in the world and in Nepal	1
2	Green revolution agriculture, food production, security, agro-environment and farmer's livelihood	1
3	Principles of organic farming; ecology, care, health and fairness	2
4	Components of organic farming; land, soil and water, crop and animal, renewable energy source, indigenous knowledge and biodiversity	4
5	Organic pest management; Principle and practices	2
6	Livestock integration in organic farming, and organic production	2
7	Marketing of organic products; organic standards, certification and accreditation, organic trade worldwide in relation to WTO	2
8	Recent trends and advances in organic farming, constraints and opportunities	1
	Total	15

B. Practicals

S.N.	Topic	No. of Practicals
1	Organic crop/ nutrient management	2
2	Assessment of composting (rural and urban), vermicompost, biofertilizer green manuring and mulching	3
3	Study on bio-pesticides in organic farming	2
4	Study of traditional/under exploited crops	2
5	Designing of organic farming (BIF/BIG) and economic analysis	3
6	Case study of successful organic growers in Chitwan	3
	Total	**15**

REFERENCES

Jaisi, S. 2062. An introduction to organic farming (in Nepali). Treta Agro-Cencern Pvt. Ltd., Nawalparasi, Nepal.

Bhandari, D. R.2063. A handbook of organic agriculture. Janaki Bhandari, Rupandehi, Nepal.

Dhama, A. K. 1997. Organic farming for sustainable agriculture (2nd ed.). Agro-Botanica, Bikaner, India.

Eyhorn, F., M. Heeb and G. Weidmann, 2002. Training manual for organic agriculture in the tropic. International Federation of Organic Agricultural Movement (IFOAM), Germany.

Periodicals and News Letters published by NPG, USC Nepal, World Neighbor, World Vision, ICIMOD, Helvetas and related I/NGOs in the country.

Periodicals and News Letters published by ILEA, IFOAM, Slow Food, Grain, etc.

ANIMAL BREEDING

Course Code : ANB 321

Course Title : Principles and Practices of Animal 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 understand basic principles and fundamentals of animal breeding, and application of animal breeding technique.

I. SYLLABUS

Animal breeding, importance and its scope in livestock improvement. Genetic resources of Nepal. Variations and causes of variation importance of heredity and environment. Gene action. Concept of heritability and repeatability. Concept of genetic resistance to diseases and parasites. Selection differential, methods and basis of selection; Mating system inbreeding and out breeding. Nuclear transplantation, transgenic animal production and its significance in genetic improvement of livestock Hormonal mechanism in reproduction, male and female reproductive system, estrus detection, estrus cycle and induction of synchronization of ovulation. Introduction advantages and limitation of A.I, method of semen collection, dilution, preservation, thawing, transportation and technique of A.I. Importance of embryo transfer, super ovulation, synchronization, collection and transfer of embryo.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Introduction, history and importance of animal breeding	1
2.	Genetic resources of Nepal	2
3.	Variation and causes of variation	2
4.	Important Economic traits of livestock and poultry	1
5.	Importance of heredity and environment	2
6.	Gene action (additive and non additive)	1
7.	Concept of heritability and repeatability	2
8.	Selection (principle, basis, method, selection parameters)	4
9.	Mating system (inbreeding, out breeding)	2
10.	Transgenic animals and significance of transgenic animals	1
11.	Molecular genetics and animal biotechnology	1
12.	Hormone, male and female reproduction system estrus detection and induction of synchronization of ovulation	4
13.	Introduction of A.I., method of semen collection, dilution, preservation, and transfer of A.I.	4
14.	Embryo transfer technology, importance, super ovulation and method of collection and transfer	3
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Estimation of repeatability and heritability	3
2.	Estimation of variance components, means, breeding value, PBA, MPPA	2
3.	Calculation of inbreeding relationship and coefficient	1
4.	Estimation of selection parameters, selection index etc	2
5.	Preparation of A.V. and collection of semen	2
6.	Evaluation of semen	2
7.	Heat detection indifferent farm animals	1
8.	Palpation of female reproduction organ	1
9.	Insemination technique	1
	Total:	15

REFERENCES

Hafez, E.S.E. 1989. Reproduction in farm animal. 5th edition Lea & Febiger, Philadelpha.

Johanson, I. and Rendel, J. 1968. Genetics and animal breeding.

Lasley, F.J. 1986. Genetics of livestock improvement.

Nagabhushanam R. Kodarkar M.S. and Sarojini S. 1999. A Text Book of Animal Physiology. 2nd edition Oxford and IBH Publishing Co. Pvt. Ltd. 66, Janpath, New Delhi.

Satisbury, G.W., Vandam Mark M.L. and Lodge J.R. 1988. Physiology of reproduction and articifical insemination of cattle. W.H. Freeman and Company Sanfrancisco.

ANIMAL NUTRITION AND FODDER PRODUCTION

Course Code : ANU 221
Course Title : Fodder Production and Pasture Management
Credit Hours : 2 (1+1) Full Marks: 50 Theory: 25 Practical: 25

OBJECTIVES

Upon completion of this course, the students will be able to understand the basic principles of fodder and forage production and preservation, and pasture management.

I. SYLLABUS

Terminology of fodder and pastures. Importance and scope of fodder production and pasture management in Nepal. Factors affecting chemical composition and nutritive value of fodder. Fodder plant growth development and yield; morphology of forage grasses and cereals. Cultivation practices of common annual and perennial fodder and grasses. Alternative feeding resources in use and practices. Silvi-pasture system and its importance. Pasture; common pasture species and cultivars. Pasture establishments, measurements and nutrition of grazing animals. Preservation and conservation of forage and fodder (hay and silage).

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Importance and scope of fodder production in Nepal	1
2.	Edaphic factors affecting fodder crops (climate and soil)	1
3.	Factor associated with fodder production (a) Chemical composition, (b) Species and variety & (c) Nutritive value	2
4.	Fodder plant growth, development and yield; morphology of grasses and cereals	1
5.	Cultivation practices of important legume and nonlegume including perennial grasses	2
6.	Alternative feeding resources in use and practices	1
7.	Hay and silage making and their importance	1
8.	Silvi-Pastoral system and its importance	1
9.	Introduction, definition, importance and scope of pasture	1
10	Common pasture species and cultivars	1
11.	Pasture establishment; seed quality, sowing, soil environment, cultivated seed beds and management of pasture	2
12.	Nutrition of grazing animals; nutritive value of pasture, herbage impact and composition	1
	Total:	15

B. Practicals

S.N.	Topic	No. of Practicals
1.	Identification of fodder crops, grasses, legume and tree fodder	1
2.	Sampling of forage grasses and tree fodder for chemical analysis	2
3.	Cultivation practices of annual and perennial grasses	5
4.	Treatments of straw	1

5.	Hay and Silage making	2
6.	Preparation of herbarium sheet	2
7.	Preparation of fodder tree saplings, plantation and management	1
8.	Pasture measurement procedure	1
	Total:	15

REFERENCES

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Relwani, L.L. 1979. Fodder crops and grasses. ICAR Publication.

Singh, S.B. and M. Sapkota. Animal Nutrition and Fodder production. Published by T.U.; IAAS, Rampur. Chitwan, Nepal.

Stevens, J.E. 1991. Fodder and pasture seed program. Consultant report. HMG, Nepal. DOAD, Livestock Development Project. Nepal.

Course Code : ANU 311
Course Title : Animal Nutrition and Feeding Practices
Credit Hours : 2 (1+1) Full Marks: 50 Theory: 25 Practical: 25

OBJECTIVE

This course will enable students to understand basic principles of animal nutrition and fundamental aspects of feed processing for different farm animals.

I. SYLLABUS

Terminology of animal nutrition. Comparative composition of plant and animal cells and tissues. Proximate analysis. Classification, function and deficiency symptom of nutrients. Digestion, absorption and metabolism of nutrients in different animals. Feed ingredients and their classification. Feeding standards and nutrient requirements for different farm animals.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Terminology of animal nutrition	1
2.	Comparative composition of plant and animal cells and tissues	1
3.	Classification, function, requirement and food sources of Protein, Carbohydrate, Lipid, Macro and Micro minerals, Vitamins, and Water	7
4.	Digestion of food in ruminants and non-ruminants	2
5.	Absorption of food nutrients in animals	1
6.	Metabolism of nutrients	1
7.	Feed ingredients and their classification	1
8.	Feeding standard for cattle, buffalo, sheep, goat, pig and poultry	1
	Total:	15

B. Practicals

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	1
4.	Proximate analysis of feeds and fodder	6
5.	Computation of ration for Cattle, Buffalo, Sheep, Goat, Pig and Poultry	6
	Total:	15

REFERENCES

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Course Code : HNU 421

Course Title : Applied Human Nutrition

Credit Hours : 2 (2+0) Full Marks: 50 Theory: 50 Practical: 00

OBJECTIVES

Upon the completion of this course, the students will be able to develop an understanding of human health, nutritional requirement, and function of nutrients for human body.

I. SYLLABUS

Relation of food and nutrition to health. Classification of foods: functions, requirements, deficiency symptoms and food sources. Measures of energy, forms of energy, measurement of energy and basal metabolism. Energy requirements for different categories of people. Balanced diets for different age groups. Nutrient loss. Anti nutritional factors present in common foods. Malnutrition, causes and effect of malnutrition. Nutritional deficiency diseases and their preventive measures.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Terminology related to human nutrition	1
2.	Relation of food and nutrition to health	1
3.	Classification of foods	1
4.	Classification, functions, requirements, deficiency symptoms and food sources of the followings: Water	9

	Carbohydrates	
	Protein	
	Lipids	
	Minerals	
	Vitamins	
5.	Energy: Measures of energy, forms of energy Measurement of energy Basal metabolism Factors affecting basal metabolism Energy requirements for different categories of people Effect of energy insufficiency on human health Food sources of energy	7
6.	Balanced diets for different age groups: Nutrients loss during preparation, processing and post harvest. Methods of enhancing the nutritive value of foods	1
7.	Anti nutritional factors present in common foods	1
8.	Malnutrition: Causes of malnutrition Effect of malnutrition on outcome of pregnancy, Physical, mental and intellectual development, Strategies to combat malnutrition	5
9.	Nutritional deficiency diseases in developing countries and their prevention measures	2
10.	Assessment of nutritional status	1
11.	Problems, prevention and control of over feeding	1
	Total:	30

REFERENCES

King, M. 1978. Nutrition for Developing Countries. ELBS Publishing, London.

Reddy, D.V. 2001. Applied Nutrition Livestock, Poultry, Human, Pet, Rabbit and Laboratory Animal Nutrition. Oxford and IBH Publishing, New Delhi.

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Course Code : **ANU 411**
Course Title : **Mountain Agriculture**
Credit Hours : **2 (2+0)** **Full Marks** : **50** **Theory** : **50**

OBJECTIVES

Upon the completion of this course, the students will understand fundamentals of mountain agriculture with its opportunities and limitations/constraints. Students will basically learn mountain specific characteristics in relation to mountain agriculture addressing livestock, horticulture, eco-tourism and associated livelihood options.

I. SYLLABUS

Introduction; defining mountain and mountain agriculture, basic issues and specificities of mountain agriculture; mountain agricultural system; mountain agricultural and rural income diversification; improving soil and crop productivity in mountain agriculture; policies and strategies of institutions involved in mountain agricultural development; mountain livestock

genetic diversity; climate change and its impact on mountain agriculture; dominating livestock species in mountain; status of rangeland; transhumance/ herding system, challenges and constraints and sustainable development of mountain.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1	Introduction: Defining mountain and mountain agriculture, basic issues in mountain agriculture (constraints, feasibility and sustainability) and mountain specificities/ inter-linkage /imperatives	1
2	Mountain agricultural system: Traditional versus modern system, watershed, bio-diversity conservation, and NRM/Mountain agroforestry system	3
3	Mountain agricultural and rural income diversification: Mountain niche (comparative advantage), ecological bioresources, pocket area concept and development, HVC crops, horticultural crops and NTFP, Commercial farming; apiculture, silkworm, mushroom and medicinal spices), Agro-ecotourism; status and future direction, Policies and laws; development and promotion of agro-ecotourism	6
4	Improving soil and crop productivity in mountain agriculture: Soil fertility and sustainable soil management, marginal land improvements; bio-engineering technologies, cropping pattern and productivity issues, agro-eco-zoning and agricultural development, precision agriculture (GPS, GIS, remote sensing)	4
5	Institutional policies/strategies in mountain agricultural development: Policy and partnership development of mountain, mountain specific program development and advocacy support	3
6	Mountain livestock genetic diversity: Characteristics and socio-economic importance, Genetic improvement strategies for conservation	2
7	Climate change and its impact on mountain Agriculture: Mountain agriculture and peoples' livelihood, environment and eco-systems/ cropping patterns	3
8	Dominating livestock species and their role in livelihood support: Yak, Nak, Chauries, Sheep, Goat, Cattle	2
9	Status of rangeland- transhumance/herding system: Existing range situation and transhumance practice, major problems/constraints, possibilities of range improvements, future of herding as lifestyle of mountain people	4
10	Challenges and constraints and sustainable development of mountain : Sustainability of mountain agriculture, opportunities and future challenges	2
	Total	30

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Pradhan, S. M., D. Pariyar., K.K. Shrestha and J.R. Adhikary. 2003. Nepal case study: High altitude pastoral systems of Sailung and Thodung regions, Ramechhap district, Nepal. *In:* J.M. Suttie and S.G. Reynolds (eds.) Transhumant Grazing Systems in Temperate Asia, FAO, Rome. pp. 277-290.

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AQUACULTURE

Course Code: AQU 211
Course Title: General Fish and Fisheries
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 explain the types of fishes and their importance, understand their morphology and anatomy, different organ systems, and natural habitats of fishes and fisheries management.

I. SYLLABUS

Definitions, economic importance, taxonomy, morphology and anatomy, digestive system, respiratory system, reproductive system, circulatory system, excretory system, endocrine system, nervous system, aquatic habitats, fishing and fishing gears, conservation and economics.

II. COURSE OUTLINE

A. Theory

S.N.	Topic	No. of Lecture
1	Introduction: Definition of fish, fishes, Fisheries and Aquatic habitats, Economic importance of fish	2
2	Taxonomy: Classification of Super class Pisces up to family, general characters of classes, Nomenclature of classes, family, genera and species of fishes, Identification of fishes of Nepal: Zoological key, illustration, specimens, experts, Economically important food fishes of Nepal and their classification with characters	5
3	Morphology and anatomy of fish : External features of different kinds of fish, Structure and functions of skin, Structure and function of Scales and fins, Location and functions of different internal organs	4
4	Digestive system: Structures of alimentary canal in different fishes, Mechanism of digestion (digestive glands, enzymes)	3
5	Respiratory system: Structure of gills and accessory respiratory organs, Mechanisms of respiration	3
6	Reproductive system: Structures of gonads, Mechanism of gonad development (Spermatogenesis, Oogenesis)	3
7	Circulatory and Excretory system: Circulatory system, Excretory system	2
8	Endocrine system: Endocrine glands, Hormones and their actions	2
9	Nervous system: Structure of brain, Peripheral nervous system, Fisheries management	2
10	River, Lake and Reservoir fishery: Fish catch and Fishing gears, Fishing pressure and Biodiversity conservation, Fisheries economics	4
	Total	30

B. Practical

S.N.	Topic	Practical
1	External feature of fish	1
2	Fishes of Nepal (4 orders)	1

3	Fishes of Nepal (4 orders)	1
4	Fishes of Nepal (3 orders)	1
5	Scales (Placoid, Cycloid, Ctenoid)	1
6	Collection, preservation and identification	1
7	Collection, preservation and identification (Contd)	1
8	Lateral lines and different types of fins	1
9	Internal organs of fishes	1
10	Different types of alimentary canal	1
11	Gills and different accessory respiratory organs	1
12	Male and female reproductive organ	1
13	Structure of brain	1
14	Study of different aquatic habitats	1
15	Discussion and wrap up	1
	Total	15

REFERENCES

ICAR. 2006. Handbook of Fisheries and Aquaculture. Indian Council of Agricultural Research (ICAR), New Delhi.

Jhingran, V.G. 1995. Fish and Fisheries of India. Hindustan Publishing Corporation, New Delhi, India.

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Course Code: AQU 221
Course Title: General Aquaculture
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 explain the characteristics of cultivable and cultivated fish species, pond construction process, principles and practices of culture systems and various management required, postharvest principles and socioeconomics aspect .

I. SYLLABUS

Definition and biological characteristics; pond construction; water quality management; pond management; fish farming systems; hatchery management; nursing and rearing; common fish diseases and parasites; post harvest management; policy, marketing and socioeconomics.

II. COURSE OUTLINE

A. Theory

S.N.	Topic	No. of Lectures
1	Fisheries and Aquaculture; Desirable characters of fish for culture, Morphological characters, feeding habits, growth rate and reproductive behavior of Common carp and Chinese carps, Indian major carps, Tilapia, Trout, Catfish, Sahar	3
2	Pond construction: Criteria for site selection, Soil type, Water source, water quantity and quality, Pond types and construction (Dike, inlet, outlet)	3
3	Water quality management: Physical parameters – Temperature, Turbidity and Solids; Chemical parameters – DO, pH, Alkalinity, Ammonia, Orthophosphate; Biological parameters – Plankton (Phyto, Zoo, Bacterio), Detritus, Benthos, Macrophytes	4
4	Pond management: Liming and fertilization, Feed and Nutrition, Weeding and predators, Growth monitoring and harvesting	4
5	Fish farming systems: Pond culture (Mono and polyculture), Cage and Pen culture, Race way culture, Integrated fish culture	4
6	Hatchery management: Procurement and management Brood fish, Breeding techniques for carps	3
7	Nursing and rearing: Feeding, care and treatment of hatchlings, larvae (fry) and fingerlings, Fish transportation	2
8	Common fish diseases and parasites: Parasites: Protozoan, Arthropod and Worms, Fungal, Bacterial, Viral	3
9	Post harvest management: Principles of fish processing, Fish processing methods	2
10	Policy, Marketing and Socioeconomics : Government policy, Institutions and Organizations, Socioeconomics of aquaculture and fisheries	2
	Total	30

B. Practical

S.N.	Topic	Practical
1	Visit of IAAS fish farm facilities	1
2	Identification of cultivated fishes of Nepal	1
3	Survey of pond construction site	1
4	Water sampling and analysis of temperature and transparency of water	1
5	Determination of DO and pH of water	1
6	Identification of Phytoplankton, Zooplankton and Aquatic macrophytes	1
7	Pond fertilization (organic and inorganic)	1
8	Feed ingredients, preparation and Feeding	1
9	Identification of brood fish of carps	1
10	Collection and preservation of fish pituitary gland	1
11	Identification of breeding equipments and observation of breeding activities	1
12	Fishing nets and netting practice (caste net, fry net and drag net)	1
13	Study of behavioral signs of diseased fish and Examination of skin and gills	1
14	Identification of common drugs and chemicals used in fish health management	1
15	Discussion and wrap up	1
	Total	15

REFERENCES

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ENTOMOLOGY

Course Code : ENT 211
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 introductory entomology, and learn about valuable insects such as honeybee, silkworm and lac insects.

I. SYLLABUS
Introduction; Beneficial and harmful insects; External morphology – Cuticle, Head, Thorax and Abdomen; Internal Anatomy – Different systems; Metamorphosis and development; Classification and study of Economically Important orders and families of insects; Introduction to Industrial Entomology.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Introduction – Definition, position of insects in animal kingdom	1
2.	Reasons for the dominance of insects over other animals	1
3.	Beneficial and harmful insects	2
4.	External morphology: Body regions, external processes, cuticle Head: Segmentation, structure, modifications, mouth parts and their modifications, antennae and their modifications, photoreceptors (compound eyes, ocelli and stemmata); Thorax: Segmentation, structure, legs and their modifications, wing venation and their modifications; Abdomen: Segmentation and structure, abdominal appendages.	7
5.	Internal Anatomy: Digestive, Reproductive (Male and Female), Respiratory, Circulatory, Nervous and Excretory Systems.	5
6.	Insect Metamorphosis and Development	2
7.	Classification and Study of Economically Important Orders and Families of Insects: Orders – Thysanura, Odonata, Orthoptera, Dictyoptera, Isoptera, Mallophaga, Siphunculata (Anoplura), Thysanoptera, Hemiptera (Heteroptera), Homoptera, Siphonaptera, Coleoptera, Lepidoptera, Diptera, and Hymenoptera.	7
8.	Introduction to Industrial Entomology: Apiculture, Sericulture, Lacculture	5
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Study of a microscope	1
2.	Collection and preservation of insects	1

3.	External morphology of an insect	1
4.	Insect mouth parts and their modifications	1
5.	Insect antennae and their modifications	1
6.	Insect legs and their modifications	1
7.	Insect wings and their modifications	1
8.	Internal anatomy of an insect (Digestive, Reproductive (male and female), Nervous, Circulatory and Respiratory systems)	1
9.	Insect metamorphosis	1
10.	Types of larvae and pupae	1
11.	Life-cycle of honeybee	1
12.	Modern beehive and its parts	1
13.	Life-cycle of mulberry silkworm	1
14.	Life-cycle of lac insect	1
15.	Classification of insects: Important families of the orders: Thysanura, Odonata, Orthoptera, Dictyoptera, Hemiptera, Homoptera, Coleoptera, Diptera, Lepidoptera, Hymenoptera and other orders of economic importance.	1
	Total:	15

REFERENCES

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.

Richards, O. W., and R. G. Davies. 1977. Imm's general textbook of entomology. Vol. I and II. Chapman and Hall, London.

Course Code : ENT 311

Course Title : Principles and Practices of Insect-Pest Management

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

OBJECTIVES

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

I. SYLLABUS

The pest management concepts, Elements of insect-pest management, Insecticides, Cultural and economic aspects, Mechanical, physical and legislative measures, Host plant resistance, Attractants, repellents and genetic control, Parasitoids and predators, Use of insect pathogens in pest management, Pest management strategies for insects affecting man and domestic animals, Integrated insect pest management.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Agricultural crop pests and pest management concept	2
2.	Economic levels and economics of insect pest management	2
3.	Elements of plant pest management	2
4.	Insecticides in pest management	3

5.	Cultural and ecological aspects of pest management	2
6.	Mechanical, physical and legislative measures of pest management	3
7.	Plant resistance in pest management	2
8.	Attractants, repellents and genetic control in pest management	3
9.	Parasitoids and predators in pest management	3
10.	Use of insect pathogens in pest management	2
11.	Pest-management strategies for insects affecting man and domestic animals	2
12.	Integrated pest management methods (IPM)	4
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Identification of insecticides to their hazard category under laboratory condition	1
2.	Insecticides formulations and computation of doses	1
3.	Study of general parts of pesticide appliances, their common defects and remedies	2
4.	Familiarization with bioassay preparation experiments	2
5.	Familiarization with scouting techniques to common insect pests at nearby farm	2
6.	Identification and uses of microbial pesticides	2
7.	Preparation of poison baits and familiarization with male annihilation techniques	1
8.	Familiarization with trap crop experiments as a pest management strategy	1
9.	Study of botanical materials for storage pest management	1
10.	Case study	2
	Total:	15

REFERENCES

Luckmann, H.W. and R.L. Metcalf. 1982. Introduction to insect pest management. John Wiley and Sons., Inc.

Mathews, G.A. 1979. Pesticide application methods. Longman, London.

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Van Emden, H.F. 1996. Pest control, Second Edition. Cambridge University Press.

Woods, A. 1974. Pest control. Mc-Graw Hill Book Company Limited, London, UK.

Course Code : ENT 321

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 and millets, pulses, oilseeds, vegetables, fruits, industrial crops, spices and condiments grown in Nepal. Important storage grain pests and their control. Introduction and management of medical and veterinary, vector borne, polyphagous, soil hibernating and resistant insect pests.

II. COURSE OUTLINE

A. Lectures

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 cereals and millet crops and their management	3
3.	Insect pests of pulse crops and their management	2
4.	Insect pests of oilseed crops and their management	2
5.	Insect pests of vegetable crops and their management	4
6.	Insect pests of fruit crops and their management	4
7.	Insect pests of industrial crops, spices & condiments and their management	4
8.	Important storage grain pests and their control	2
9.	Introduction and management of medical and veterinary, disease vectors, polyphagous and soil hibernating insect pests	3
10.	Resistance to pests and their management	1
11.	Insect vectors and their management	1
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Periodic visits to IAAS farm for crop pests monitoring	2
2.	Farm visit for collection and identification of parasitoids, predators and crop pollinators commonly used in biological control	2
3.	Collection and identification of various insect pests of:	
	Field crops	3
	Vegetable crops	3
	Fruit crops	2
	Oilseed crops	1
	Stored grains	1
4.	Identification of rodents and mites and their management	1
	Total:	15

REFERENCES

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

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Panwar,V.P.S. 1995. Agricultural insect pests of crops and their control. Kalyani Publishers, New Delhi.

Course Code : ENT 411

Course Title : Environment Pollution and Protection

Credit Hours : 1 (1+0) **Full Marks: 25** **Theory: 25**

OBJECTIVES

Upon the completion of this course, the students will be able to understand environmental pollution, its causes, and learn about novel means to minimize pollution, especially due to pesticides in agriculture including human health with least disturbances to the environment.

I. SYLLABUS

Introduction, significance and overviews of environmental pollution, basic understandings of environmental pollutants and pollution, pollutants and pesticide pollution in Nepal, chemical use, POPs and PICs and environmental pollution (air, water and soil pollution), effect of pesticides on non-target organisms including farmers and consumers health , pesticide hazard assessment (survey/ surveillance/field monitoring and sampling for pesticide residues), integrated approach of pest management, phyto-sanitary measures- ISPMs and RSPMs, bio-diversity and use of novel approaches in agriculture and human health systems, plant quarantine pesticide acts and regulations.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1	Definition, terminologies and significance; Overviews of environmental pollution	1
2	Basic understanding of environmental pollution: Pollutants and pollution, Type of environmental pollution	2
3	Causes of environmental pollution: Overuse and misuse of chemicals in agriculture, Urbanization, industries and wastes	2
4	Effect of pesticides on non-target organisms: Pesticide residues on the environment, Pesticide residues on agriculture products, Pesticide poisoning and human health, Pesticide resistance, pest resurgence and effects on bio-agents	2
5	Pesticide hazard assessment: Pest and pesticide survey and surveillance; Field monitoring, sampling and bioassay	2
6	Integrated management of pests and pesticides: Use of novel techniques in agriculture and human health systems; Plant quarantine/phyto-sanitary measures- ISPMs and RSPMs	3
7	National policies in pest management and environment protection: Plant protection acts and regulations; Pesticide acts and regulations; Environmental protection related acts and regulations	2
8	International policies in pesticide management and environment protection: International treaties and conventions; International organizations	1
	Total	15

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Van Emden, H.F. 1996. Beyond silent spring. Chapman and Hall, UNEP.

ENVIRONMENTAL SCIENCE

Course Code : BCH 111

Course Title : General Biochemistry

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

OBJECTIVES

Upon the completion of this course, the students will be able to understand the biochemical composition of plant cells, their functions and understand the higher courses of agricultural sciences.

I. SYLLABUS

Water, pH and buffer. Structures, functions and classification: amino acids and proteins, carbohydrates, lipids, nucleic acids (DNA, RNA). Enzymes: nomenclature, classification, function, properties and mechanism. Metabolism of cellular constituents: central metabolic pathways: degradation of sucrose, starch, cellulose, acyl- glycerol and fatty acids, protein and amino acids. Biosynthesis of sucrose, starch, fatty acids, acyl–glycerol, aminoacids and protein.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1	Introduction to plant biochemistry	1
2	Water, pH and buffer	2
3	Classification, structures and functions: Amino acids and proteins Carbohydrates (structure of glucose, fructose, lactose, glycogen, starch, sucrose, pectine, hemicellulose, cellulose and chitin) Lipids Nucleic acids (DNA, RNA)	12
4	Enzymes: nomenclature, classification, function, properties and mechanism	3
5	Central metabolic pathways (Calvin- Bension cycle, Glycolysis, Kreb's cycle, electron transport chain,)	4
6	Biosynthesis of sucrose, starch, glycogen, fatty acids, triacyl glycerols, amino acid and proteins	4
7	Degradation of sucrose, starch, glycogen, cellulose, triacylglycerol, fatty acids, protein and amino acids	4
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1	Preparation of standard solution, buffers solution and colloidal solution	3
2	Qualitative tests on carbohydrates, lipids, amino acids and proteins	3
3	Quantitative estimation of reducing sugars, amino acids and proteins	3

4	Enzymatic action of potato oxidase or urease or catalase	1
5	Demonstration of: Differential centrifugation Polyaceylamide gel electrophoresis Paper chromatography Thin-layer chromatography Spectrophotometry or colorimetry	5
	Total:	15

REFERENCES

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

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

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

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

Course Code : PPH 121

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 students will be able to understand the general principles and process of physiology in relation to crop plants, and know the effect of different factors on growth and development of plants.

I. SYLLABUS

Introduction to plant physiology; Plant cell- an introduction; Laws of thermodynamics; Cell water relations; Diffusion and osmosis; Concept of water potential; Absorption of water, transpiration, and stomatal physiology; Ascent of sap; Ion uptake and metabolic utilization of mineral ions; Photosynthesis; Respiration; Translocation of organic solutes in plants; Physiology of Seed germination, Dormancy, and Photoperiodism in plants; Growth and development; Growth regulators; Physiological parameters influencing the productivity of major cereals, pulses and oilseed crops.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1	Introduction to plant physiology	1
2	Plant cell- an introduction	2
3	Laws of thermodynamics	2
4	Introduction to cell water relations	1
5	Diffusion and osmosis	1
6	Concept of water potential	1
7	Absorption of water, transpiration, and stomatal physiology	2
8	Ascent of sap	1

9	Ion uptake and metabolic utilization of mineral ions and their difficiency symptoms	3
10	Photosynthesis	4
11	Respiration	3
12	Translocation in plants (xylem and phloem)	2
13	Physiology (physical aspects) of growth and development	2
14	Seed germination, Dormancy, vernalization and Photoperiodism in crop plants.	2
15	Growth regulators and their effects in crop plants	2
16	Physiological parameters influencing the productivity of major cereals, pulses and oilseed crops	1
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
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 and dicot leaves	2
4.	Study of the process of transpiration with the help of cobalt chloride paper, potometer, and bell jar	1
5.	Demonstration of photosynthetic pigments by paper chromatography and calorimeter	1
6.	Study the factors affecting the process of photosynthesis	1
7.	Study the process of root pressure by exudation method and transpiration pull method	1
8.	Study the field symptoms of certain essential micro and macro-mineral elements in crop plants	1
9.	Study of the process of aerobic respiration and alcoholic fermentation	1
10.	Study of anatomy of C_3 and C_4 plant leaves	1
11.	To study the measurement of growth (height and weight)	1
12	Effect of GA on different physiological processes (dormancy, germination, growth and flowering)	2
13.	Field visit for physiological in crop plants	1
	Total:	15

REFERENCES

Devlin, R. M. and R. H. Witham. 1986. Plant physiology (4th edition), CBS Publication and Distribution, Delhi.

Gupta, U. S. (ed.). 1978. Crop physiology. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Meye, B. S., D. B. Anderson, R. N. Bohning and D. G. Fratianne. 1973. Introduction to plant Physiology. D. Van Nostrand Co., New York.

Saxena, S. K. 1995. Modern Practicals in plant physiology and biochemistry. CBS Publications and Distributors, New Delhi, India.

Course Code : MIB 121

Course Title : Agricultural Microbiology

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

OBJECTIVES

The main objective of this course is to teach students about the importance and role of microbes in plants, and enable them to understand the microbial composition of the soil and their functions to increase productivity.

I. SYLLABUS

Introduction to microorganisms, 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, phosphorus and sulphur transformations; Plant- microbes association: symbiotic, associative and non-symbiotic nitrogen fixation, Azolla, blue green algae and mycorrhiza; Biodegradation of agricultural chemicals: insecticides, fungicides and herbicides; Microbial degradation of cellulose, starch, lipids, lignin, pectin and proteins present in organic residues; Introduction to plant pathogenic microorganisms; Microbiology of milk and milk products, food borne infections and toxins; Introduction to rumen microbiology and role of microbes in silage production. Microorganisms in human welfare (e.g. fermentation and antibiotics), biopesticides and biofertilizers.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Introduction to microorganisms, their distribution, historical background and their importance in agriculture	2
2.	Prokaryotic and eukaryotic microorganisms; their cell structure and functions	3
3.	Nutritional requirement and genetics of bacteria	2
4.	Role of microorganisms in soil fertility and crop production; carbon, nitrogen, phosphorus and sulphur transformations	3
5.	Plant- microbes association: symbiotic, associative and nonsymbiotic nitrogen fixation, Azolla, blue green algae and mycorrhiza	6
6.	Biodegradation of agricultural chemicals: insecticides, fungicides and herbicides	3
7.	Microbial degradation of cellulose, starch, lipids, lignin, pectin and proteins present in organic residues	2
8.	Introduction to plant pathogenic microorganisms	2
9.	Microbiology of milk and milk products, food borne infections and toxins	2
10.	Introduction to rumen microbiology and role of microbes in silage production	2
11.	Microorganisms in human welfare (e.g. fermentation and antibiotics), biopesticides and biofertilizers	3
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Studies on methods of sterilization	1
2.	General media preparation for bacteria and fungi	1
3.	Isolation and enumeration of bacteria, fungi, and actinomnycetes	3
4.	Purification of microbial culture	1
5.	Staining and microscopic examination of fungi and bacteria	1
6.	Morphological characteristics of bacteria, fungi and algae	1
7.	Characteristics of culture of bacteria and fungi	2
8.	Qualitative examination of soil microbes (fungi and bacteria) by buried slide method	1
9.	Preparation of mycorrhizal samples and their microscopic examination for mycorrhizal association in plants	3
10.	Demonstration of fermentation process	1
	Total:	15

REFERENCES

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

Merchants, I. A. and R. A. Palker. Veterinary bacteriology and virology. C. B. Publishers and Distributors, Delhi.

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

Rangaswamy, G. and D. J. Bhagyarai. 1993. Agricultural microbiology (2nd ed.). Asia Publishing House, New Delhi.

Course Code : ECO 211

Course Title : Environmental Sciences and Agro-Ecology

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

OBJECTIVES

Upon the completion of this course, the students will know the concepts of environmental science and ecology, apply different methods of EIA, and understand energy flow and food chains in the ecosystems.

I. SYLLABUS

Environmental science: Introduction; environmental issues; environmental impacts on agriculture; Environmental Impact Assessment and Monitoring; environmental conservation and management strategies; urbanization; global warming; climatic change: causes and effects on agriculture. Agroecology: introduction; factors; agricultural ecosystems; dynamics of agricultural ecosystem; population ecology; interactions of crop with pests; dynamics of pest populations; management strategies; genetic resistance in crops; ecology of production systems; sustainability of ecological systems.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Introduction: Definition, branches, scope, and concepts of environmental studies, with particular reference to Nepal. Interrelationships between human population and natural environment.	2
2.	Environmental issues: population, deforestation, urbanization, pollution, waste disposal, pesticide uses and abuse	2
3.	Environmental impacts on agriculture: Types and sources of pollutants (air, soil and water) and their impacts on agro-ecosystems, soil erosion, impact of long term application of agrochemical, eutrophication and water contamination.	3
4.	Environmental impact assessment and monitoring: Environmental quality; methods of environmental impact assessment/initial environmental examination	2
5.	Conservation and management strategies: Strategies used in developed and developing countries; problems associated with implementing developmental activities; Government's policy, laws and programs regarding environmental conservation; Strategies for social, biological and physical stability. People's participation in environmental management.	4
6.	Urbanization, global warming and climatic change: Factors causing global warming and its adverse effect on agricultural production and Climate change.	2
7.	Agro-ecology: Introduction, definition, branches, scope, importance and interrelationships of agricultural ecology with agricultural productivity	2
8.	Farmhouse ecology: Farmers, crops, pet animals, and farms (environment including climatic, edaphic, physiographic and biotic components).	2
9.	Ecological principles: Concepts (agriculture as an ecological system), structure, function, biotic and abiotic components of ecosystems and their linkages. Energy flow, ecological pyramids, food chains and food webs, trophic level.	3
10.	Agricultural ecosystem dynamics: Biological changes in agricultural ecosystems, crop responses to environmental factors and occurrence of ecological processes such as nutrient cycling, water balance, and species interactions	2
11.	Population ecology: Interactions of crop with weeds, plant pathogens, insects and nematodes, dynamics of pest populations and effect of different management strategies on crop production.	2
12.	Agro-ecology of production systems: multiple cropping, crop rotations, cover cropping, agro-forestry systems, minimum and zero tillage, living mulches, organic farming systems, shifting cultivation and other traditional agriculture.	2
13.	Sustainability of agro-ecosystems: Challenges, strategies and requirements for sustainable agriculture; analysis of sustainable and small farm systems.	2
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Record and analyze the climatic data	1
2.	Estimate dissolved oxygen and CO_2 in water (Winkler's Method)	2
3.	Preparation of statement on environmental impacts of local industries, roads and farms.	2
4.	Study the effects of environmental pollutants (sugar mill or paper and pulp mill effluents) on seed germination of crops and weeds	2
5.	Count and record the individuals of crop-weeds of an agro-ecosystem	1
6.	Measurement of primary productivity by harvest method	1
7.	Study the cropping density and count the seed production.	2
8.	Study interspecific and intraspecific competitions	1
9.	Study the effect of plant extract on seed germination (Allelopathic or kairophathic study)	2
10.	Study the solid waste production in a nearby settlement	1
	Total:	15

REFERENCES

Altein, M. A. 1987. Agro-ecology. The Scientific Basis of Alternative Agriculture. Westview Press, Colorado.

Arumgam, N. 1994. Concepts of Ecology (7th ed.), Saras Publication, Nagercoil.

Jha, P. K., G. P. S. Ghimire, S. B. Karmacharya, S. R. Baral and P. Lacoul. 1996. Environment and Biodiversity. ECOS (Nepal), Kathmandu.

Sharma, P. D. 1992. Ecology and Environment. Rastogi Publication, Meerut.

Course Code : ECO 311

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, students will be able to understand the status, importance, values, uses and management of medicinal and aromatic plants (MAPs) in Nepal.

I. SYLLABUS

Introduction, history, classification, trade, importance, prospects and constraints of medicinal and aromatic plants. Research status of MAPs in Nepal. Extraction and storage methods for MAPs. Plant profile, description, origin and distribution, cultivation, management, harvesting and chemical evaluation of the medicinal and aromatic plants.

II. COURSE OUTLINE

A. Lecturer

S.N.	Topic	No. of Lectures
1.	Introduction, history, classification, trade, importance, prospects and constraints of medicinal and aromatic plants.	2
2.	Research status of MAPs in Nepal.	2
3.	Extraction and storage methods for MAPs	2

4. Plant profile, descriptin, origin, distribution, cultivation, management, harvesting and chemical evaluation of

(a) Medicinal plants:	
Aloe, Datura	1
Digitalis, Periwinkle	1
Rauvolfia	1
Sacred basil, Sweet flag	1
Neem	1
(b) Aromatic plants:	
Chamomile, Citronella, Lemon grass	1
Pamarosa, Ginger grass, Khus	1
Lemon scented gum, Mint	1
Rose and Rosemary	1
Total:	15

B. Practicals

S.N.	Topic	No. of Practicals
1.	Identification, recording and reporting the uses of important medicinal plants	4
2.	Identification of important high value herbs, aromatic plants and their products	2
3.	Nursery bed preparation and planting of medicinal and aromatic plants	3
4.	Extraction methods of aromatic plants	2
5.	Preparation and pre-testing of questionnaire designed for recording traditional uses of locally available herbs/MAPs.	2
6.	Field observation of herbal farms and processing plants.	2
	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, Jaoipur, 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, USA.

Course Code : ECO 412

Course Title : Agrobiodiversity Management

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 concepts, diversity and centers of origin, ways of sustainable uses and value addition, policy and laws and conservation and management of agrobiodiversity.

I. SYLLABUS

Concepts, aims, scopes and research trends. Classification, Diversity, and distribution of agrobiodiversity with special reference to Nepal. Understanding centers of crop and animal genetic resources, causes and consequences of loss of agrobiodiversity, traditional uses and value addition. Current national policy and international conventions and treaties on conservation and management of agrobiodiversity, Agrobiodiversity prospecting, intellectual property rights (IPRS), plant breeders' rights and farmers rights on crop and animal genetic resources.

II. COURSE OUTLINE

A. Lectures

S.N.	**Topic**	**No. of Lectures**
1	Introduction to agricultural biodiversity: Concepts, history, importance and prospects of agricultural biodiversity; Centers of origin of cropd and animal diversity; Research and development in agricultural biodiversity	1
2	Components of agricultural biodiversity: Crop genetic resources: Crops and their relatives, Animal genetic resources: Livestock and their relatives, Aquatic genetic resources, Soil flora and fauna diversity for soil fertility management, Species of ecosystem services related to agricultural production, e.g. bees, silkworms and butterflies; Pests (weeds, insect pests, fungal pathogen, bacteria, viruses and nematodes); Agro-forestry resources	3
3	State of agricultural biodiversity management: Present status of agricultural biodiversity conservation and utilization in Nepal; Trend of agricultural biodiversity management	2
4	Documenting and assessing uses and threats of agricultural biodiversity: Methods and advances in documentation of genetic resources, traditional knowledge and practices (CBR, Biodiversity Fair); Assessment of genetic resources (Four cell analysis, ecological foot print etc.); Emerging threats to agriculture biodiversity and key measures to reduce the threats (Biotic, abiotic, climate change, socio-political, institutions)	3
5	Conserving and managing agricultural biodiversity: Concept and theory of conservation and management of biological resources ; Strategies for conservation and utilization of agricultural biodiversity (Economical and socio-cultural value based); Approaches for conservation and utilization of agricultural biodiversity (In situ, Ex situ, On farm methods, through CBM approach); Value addition of agriculture biodiversity through breeding and non-breeding: market methods, linking with tourism	3
6	Policies, laws and institutional mechanisms : Global Plans/Strategies, Legal Instruments and Institutions *(with special reference to CBD, ITPGRFA, WTO/TRIPS, WIPO, ILO 169)*; Regional Cooperation on Agriculture Biodiversity Conservation and Development *(with special reference to SAARC)*; National Policies and Laws on Agriculture Biodiversity Conservation and Development *(with special reference to CBD, ITPGRFA, WTO/TRIPS, WIPO, ILO 169)* ; Implementation Challenges for Intellectual Property Rights and the Rights of Local, Indigenous and Farming Communities *(corporate-led vs. community-led agriculture biodiversity management)* ; Institutional Framework for the Effective Implementation of Policies and Laws in Nepal *(with special*	3

reference to Govt., community and other institutions, including NGOs and Media)

Total: 15

B. Practicals

S.N.	Topic	No. of Practicals
1	Documentation of indigenous knowledge on agrobiodiversity of home gardens	2
2	Assessment of the genetic resources by four cell analysis method	2
3	Study of the genetic resources displayed in Biodiversity Fair / Local Knowledge and Innovation Resource Centre	2
4	Seed collection and display in seed bank for Local Knowledge and Innovation Resource Centre/Museum (IAAS)	3
5	Study of on-farm conservation and management of agrobiodiversity in campus periphery	3
6	Case studies : Field Gene Bank, Community Seed Bank, Cryopreservation of plant and animal genetic resources, Ecofarm park	3
	Total:	15

REFERENCES

Adhikari, K. 2008. Intellectual property rights in agriculture: Legal mechanisms to protect farmer's rights in Nepal. PRO-Public and SAWTEE, Kathmandu, Nepal.

Adhikari, R. and K. Adhikari. 2003. Farmers' rights to livelihood in the Hindu-Kush Himalayas. SAWTEE, Kathmandu, Nepal.

Belbase L. N. and N. Belbase. 2000. Jaibik Vividhatako Samrakshan: Shroat Shangalo. Pro-public, Kathmandu, Nepal.

Chaudhary, R. P. 1998. Biodiversity in Nepal: Status and conservation. S. Devi, Saharanpur, India and Tecpress Books, Bangkok, Thailand.

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Jha, P. K., G. P. S. Ghimire, S. B. Karmacharya, S. R. Baral and P. Lacoul. 1996. Environment and biodiversity. ECOS (Nepal), Kathmandu, Nepal.

Sthapit, B (ed.). 1996. Proceedings of Working Seminar on Managing Agricultural Biodiversity for Sustainable Mountain Agriculture: Issues and Experiences, March 15-16, 1996, Pokhara, Nepal. Local Initiatives for Biodiversity, Research and Development (LI-BIRD, Pokhara, Nepal.

Sthapit, B. R., M. P. Upadhyay, B. K. Baniya, A. Subedi and B. K. Joshi (eds.). 2003. On-farm management of agricultural biodiversity in Nepal: Proceedings of a National Workshop, 24-26 April 2001, Lumle, Nepal. NARC, LI-BIRD, IPGRI, Netherlands Ministry of Foreign Affairs Development Cooperation, SDC (Swiss Agency for Dev. & Coop.).

Sthapit, B., M. P. Upadhyaya and A. Subedi (eds.). 1999. A scientific basis of in-situ conservation of agrobiodiversity on-farm: Nepal's contribution to the global project. NP Working Paper No. 1/99. NARC, LI-BIRD, IPGRI, Nepal.

Wilson, E. O. (ed.) 1988. Biodiversity. National Academy Press, Washington D.C., USA.

HORTICULTURE

Course Code : HRT 111
Course Title : Introductory Horticulture
Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES
This course provides students with the knowledge and skill about principles and practices of basic horticulture.

I. SYLLABUS
Definition, branches, classification and importance of horticultural crops; relation to other disciplines; ecological regions and niches in Nepal for different horticultural crops; feasibility of horticulture development in Nepal; climatic factors affecting crop production- light, temperature, heat budget, rain, humidity; measures to overcome environmental stress; basic principles of orchard establishment. Soils for fruit trees. Principles and practices of plant propagation, training and pruning of fruit trees and vines; orchard management practices, manure and fertilization, irrigation and drainage; inter-cropping, soil and water conservation practices; juvenility, flowering, pollination, fruit set and fruit growth, ripening and fruit drop, tuber and bulb formation; plant growth substances in horticulture; high density and multistoried planting, organic farming, off-season production and protected horticulture; subsistence; peri-urban horticulture; horticulture; genetic resources and indigenous horticultural plants.

II. COURSE OUTLINE
A. Lectures

S.N.	Topic	No. of Lectures
1.	Definition, branches and classification of horticultural crops	1
2.	Relation to other disciplines	1
3.	Importance of horticultural crops in Nepal	1
4.	Ecological regions and niches for different horticultural crops in Nepal	1
5.	Feasibility of horticulture development in Nepal	1
6.	Climatic factors affecting horticultural crop production: light, temperature and heat budget; rain, humidity, hailstone and wind	2
7.	Measures to overcome environmental stress	1
8.	Basic principles of orchard establishment: site selection, layout and planting	2
9.	Soils for fruit trees	1
10.	Principles and practices of plant propagation: sexual, vegetative, mist and micro propagation	2
11.	Principles and practices of training and pruning: objectives, system of training, types of pruning and pruning of different fruit crops	2
12.	Orchard management practices: soil fertility management; irrigation and drainage; soil water conservation measures	2
13.	Growth and development: seed and bud dormancy, germination; juvenility and its characteristics; unfruitfulness, flowering, fruit set, fruit growth and fruit drops; fruit ripening, tuber and bulb formation	5

14.	Plant growth substances, classes, function and uses	3
15.	Principles of off- season and protected horticulture	1
16.	Organic forming, needs and prospects	1
17.	Principles of high density and multi-storied cropping	1
18.	Principles of peri-urban horticulture and soil less culture, hydroponics and aeroponics	1
19.	Genetic resources and indigenous horticultural plants	1
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Identification of horticultural tools and equipment	1
2.	Identification of fruits, vegetables and ornamental plants	1
3.	Identification of major horticultural crop growing areas and regions of Nepal	1
4.	Layout of orchard for different systems of planting fruit crops	1
5.	Preparation of contour line for planting trees across the sloping land	1
6.	Preparation of planting pit and planting of fruit saplings	1
7.	Training of fruit trees at juvenile stage	1
8.	Pruning of mature fruit trees	1
9.	Propagation of fruit trees from grafting, budding, layering, and cutting	4
10.	Preparation of different concentrations of PGR for horticultural uses	1
11.	Preparation and use of Bordeaux Mixture/paste in fruit trees	1
12.	Preparation of hot bed for germination of vegetable seed in winter	1
	Total:	15

REFERENCES

Chattopadhaya, T. K. 1994. A Text Book on Pomology. Vol. I. Ludhiana, Kalyani Publishers.

Kunte, Y.N. and K.S. Yawalkar. 1991. Introduction to Principles of Fruit Growing. Nagpur, Agri. Horticultural Publication.

Prasad, S. 1997. Principles of Horticulture. Agro-Botanics, Bikaner.

Prasad, S. 1997. Agros. Dictionary of Horticulture. Agro-Botanics. Bikaner.

Course Code : HRT 121

Course Title : Ornamental Horticulture

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

OBJECTIVES

This course provides basic knowledge and skill about principles and practices of landscape designs and cultivation practices of major ornamental plants in Nepal.

I. SYLLABUS

Importance of ornamental gardening in human life; classification of ornamental plants based on their aesthetic and functional uses; styles of gardening and their components; landscape and town planning; indoor gardening, pot culture, hanging basket and bonsai; flower arrangement; exhibition and flower judging; establishment and maintenance of lawn; establishment of nursery enterprises, nursery media, containers, equipment and structures;

cultivation of rose, bougainvillea, tuberose, gladiolus, orchids, dahalia, chrysanthemum, marigold, gerbera, cactus and succulants plants and protected cultivation of flowers. Post harvest aspect of cut flowers and vase studies.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Importance of ornamental gardening in human life	1
2.	Classification of ornamental plants based on their aesthetic and functional uses	2
3.	Styles of gardening and their components	2
4.	Landscape and town planning	1
5.	Elements and principles of landscape gardening	2
6.	Factor affecting landscape design	1
7.	Indoor gardening, pot culture and hanging basket	1
8.	Types of indoor plants, culture media and types of pots	1
9.	Care and maintenance of indoor plants	1
10.	Bonsai making	1
11.	Flower arrangement; exhibition and flower judging	1
12.	Establishment and maintenance of lawn	1
13.	Establishment of nursery enterprises	1
14.	Nursery media, containers, equipment and structures	2
15.	Important cut flower plants; pre and post harvest life of cut flowers	2
16.	Cultivation of important ornamental plants and protected cultivation of flowers	10
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Identification of ornamental plants with reference to habit, season of flowing, color of flowers and uses	1
2.	Preparation of annual bed for seeding seasonal flowers	1
3.	Preparation of lawn	1
4.	Preparation of *Bonsai*	1
5.	Flower arrangement	1
6.	Maintenance of indoor plants	1
7.	Designing gardens for residential and public purpose	2
8.	Training and pruning of ornamental plants	1
9.	Propagation of ornamental plants by cutting , budding and specialized parts	2
10.	Preparation of media for potting ornamental plants	1
11.	Potting, repotting and manuring of indoor plants	2
12.	Herbarium collection of ornamental plants	1
	Total:	15

REFERENCES

Arora, J.S. 1990. Introductory Ornamental Horticulture. Kalyani Publishers, New Delhi.
Bose, T.K. and L.P. Yadav. 1989. Commercial Floriculture. Floritech Publ., Banglore.
Randhawa, G.S. 1973. Ornamental Horticulture in India. Today and Tomorrows Printers and Publ., New Delhi.
Randhawa, G.S. and A. Mukhopadhaya. 1986. Floriculture in India. Allied Publ. Ltd., New Delhi.
Somani, L.L. 1996. Dictionary of Gardening. Agro-tech. Publishing Academy, Udaipur.

Course Code : HRT 211

Course Title : Fruit and Plantation Crop Production

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

OBJECTIVES

This course provides basic knowledge and skill about principles and practices of fruit and plantation crop production with special emphasis on management practices and marketing.

I. SYLLABUS

Importance, scope and history of fruit development in Nepal, cultivation practices of growing temperate, tropical and sub tropical fruit crops with reference to their origin, botany, uses, distribution, area and production, climate, soil, varieties, planting, propagation, training and pruning, flowering, fruit set, fruit drops, nutrition, manure and fertilizers, irrigation, inter-cropping, use of bio-regulators, disease and insect pests, major physiological problems, harvesting, storage and marketing of apple, pear, peach and plum, walnut, apricot; citrus, grape, strawberry, guava, mango, banana, papaya, pineapple, litchi; and plantation crop; tea and coffee.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Importance, scope and status of fruit crops in Nepal	1
2.	History and government policy of fruit development in Nepal	1
3.	Constraints of fruit production in Nepal	1
4.	Cultivation practices of	
	I. Temperate fruits:	
	Apple and pear	3
	Peach and plum	1
	Apricot and walnut	1
	Grape	1
	Minor temperate fruits	2
	II. Tropical and subtropical fruits:	
	Citrus	3
	Mango	2
	Banana	2
	Papaya	1
	Pineapple	1
	Litchi	1

	Guava	1
	Strawberry	1
	Jack fruit	1
	Minor fruits	1
	Indigenous and under exploited fruit crops	1
III.	Plantation crops:	
	Tea	2
	Coffee	2
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Identification of major temperate, subtropical and tropical fruit trees	1
2.	Pomological classification of fruit trees	1
3.	Training and pruning of major fruit trees	1
4.	Vegetative propagation of fruit trees	2
5.	*In vitro* propagation of fruit trees	2
6.	Flowering and fruiting behavior of major fruit crops	1
7.	Preparation of different formulation and application of PGRs for flowering, fruit set and fruit ripening	2
8.	Fertilization and manuring fruit trees	1
9.	Study of different systems of irrigation fruit trees	1
10.	Preparation and uses of pesticides in fruit trees	1
11.	Plant growth efficiency and yield measurement of fruit trees	1
12.	Processing of coffee	1
	Total:	15

REFERENCES

Bal, J.S. 1990. Fruit Growing. Kalyani Publishers.

Bose, T.K. and S.K. Mitra. 1990. Fruits- Tropical and Subtropical . Naya Prakash, Culcutta.

Chattopadhya, T.K. 1996. A Text Book on Pomology (Tropical Fruits). Vol. II and lll Kalyani Publishers. Ludhiana.

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.

Mitra, S.K., T.K. Bose and D.S. Rathore. 1991. Temperate Fruits. Horticulture and Allied Publishers, Culcutta.

Course Code : HRT 221

Course Title : Vegetable and Spice Crop Production

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

OBJECTIVES

This course provides basic knowledge and skill on principles and practices of vegetable and spice production with emphasis on cultivation, off-season production, post harvest handling and marketing.

I. SYLLABUS

Importance, scope and status of vegetable production in Nepal; cultural practices with respect to origin, distribution, area, production, botany, variety, climate and soil, field management, off season production; seed production, disease and insect pest, harvesting, post harvest handling and marketing of: potato and solanaceous fruits, onion, cole crops, cucurbits, root crops, bean, peas, leafy vegetables, and okra; spices: ginger, turmeric, garlic, cumin, coriander, and fenugreek; introduction to indigenous, under-exploited and minor crops.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Importance, scope and status of vegetable and spices production in Nepal	2
2.	Cultural practices including origin and distribution, area and production, botany, climate and soil, variety, field management, off season production, disease, pest and other problems and their remedies, seed production, harvesting, post harvest handling and marketing of following vegetables and spices:	
	Potato, tomato, egg plant, chilli and sweet pepper	3
	Rayo, spinach, cress, and swiss chard	3
	Cauliflower, cabbage and, broccoli	3
	Radish, carrot and turnip	3
	Peas and beans	2
	Cucumber, water melon, bitter gourd, bottle gourd, sponge gourd pumpkin and summer squash	3
	Onion and garlic	2
	Okra	1
	Ginger and turmeric	2
	(j) Coriander, fenugreek and cumin	2
6.	General introduction of minor and under exploited vegetables: chayote, lettuce, pointed gourd, sweet potato, dill, yam, asparagus, garden beet, drumstick, colocasia, tree tomato, brussels' sprouts, cassava, knol khol, celery, parsnip, and amaranthus	4
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Identification of vegetables and spice crops	1
2.	Identification of seeds of vegetables and spices	1
3.	Nursery raising of vegetables	1
4.	Practice on transplanting and watering	1
5.	Identification of major cultivars of major vegetable crops	1
6.	Practices on various intercultural operation and mulching	1
7.	Staking and pruning	1
8.	Practices on manure and fertilizer application	1
9.	Pesticide spray	1
10.	Use of PGRs	1

11.	Harvesting and processing for marketing	1
12.	Display and judging of fresh vegetables	1
13.	Study morphological characters of edible parts of major crops	1
14.	Forcing cucurbits in winter	1
15.	Layout of kitchen garden	1
	Total:	15

REFERENCES

Bose, T.K., M.G. Som and J. Kabir. 1993. Vegetable Crops. Naya Prakash, Calcutta.

Pun, L. and B.B. Karmacharya. 1988. Trainer's Manual – Vegetables. Department of Agriculture, Agric. Manpower Development and Training Program, Kathmandu.

Shanmugavelu, K.G. 1989. Production Technology of Vegetable Crops. Ocford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Singh, S.P. 1997. Principles of vegetable Production. Agrotech Pub. Academy, Udaipur.

Singh, S.P. 1989. Production technology of vegetable crops. Universal Pub. Centre, Karnal, India.

Course Code : HRT 311

Course Title : Agroforestry

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

OBJECTIVES

This course provides basic knowledge about principles and practices of agroforestry systems.

I. SYLLABUS

Concept of agroforestry: definition, importance and scope; role of trees in food, fodder, fuel, timber supply and soil and water conservation; classification of agroforestry systems; indigenous and modern systems; interaction between trees and crop/livestock components; consideration for agroforestry system development and design: bio-physical and socio-economical; Agroforestry design and development: ICRAF's diagnosis and design methodology, FSRE approach to agroforestry; Soil and water conservation strategies for agroforestry; and agroforestry projects and practices in Nepal.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Definition, components, importance and scope of agroforestry in Nepal	1
2.	Roles of tress in food, fodder, fuel, timber supply and soil and water conservation	1
3.	Scenario of forestry situation in Nepal and Asia	1
4.	Characteristics of trees for agroforestry development	1
5.	Classification of agroforestry systems	1
6.	Shifting cultivation: practices, problems and potential	1
7.	Indigenous agroforestry system in Nepal	1
8.	Modern agroforestry systems	2
9.	ICRAF's diagnosis and design approach to agroforestry project planning	2

	and implementation	
10.	FSRE approach to agroforestry	2
11.	Productivity and sustainability	1
12.	Quantitative assessment on woody species	2
13.	Criteria for selecting allay cropping intervention	1
14.	Design information for allay cropping technology	1
15.	Stages of technology development in agroforestry projects	1
16.	Soil and water conservation strategies through agroforestry approach	1
17.	Agroforestry models	2
18.	Silviculture of some agroforestry species	2
19.	Sloping agriculture land technology	2
20.	Tree - crop/ livestock interaction	3
21.	Agroforestry projects in Nepal	1
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Preparation of 'A' frame	1
2.	Estimation of tree height	1
3	Determination of land slope	1
4	Study of charecteristics of tree for agroforestry system	1
3.	Determination of contour line by 'A' frame	1
4.	Practices of developing different agroforestry models	2
5.	Nursery and plantation of agroforestry	1
6.	Identification of agroforestry species	1
6.	Study of different SATL models	1
7.	A case study of agroforestry system and its presentation	2
8.	A visit to agroforestry project	1
9.	Presentation of agroforestry designs/models	2
	Total:	15

REFERENCES

Chundawat, S.B. and S.K. Gautam. 1996. Oxford and IBH Publishing Co. Pvt. Ltd., India.

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

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

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

Course Code : HRT 321

Course Title : Post Harvest Horticulture

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

OBJECTIVES

This course provides basic knowledge and skill on principles and practices of handling, processing, storing and marketing of fresh and perishable horticultural commodities.

I. SYLLABUS

Importance and status of post harvest horticulture in Nepal; commercial post harvest procedures- an integrated strategy; major constraints in the development of post harvest enterprises; characteristics of fruits and vegetables; post harvest physiology of fruits, vegetables and cut flowers; post harvest disease and pest; quality of horticultural produce; pre-harvest factors affecting quality; temperature management, storage and transportation; post harvest commodity profile: vegetables, fruits, cut and pot flowers; processing and preservation of fruits and vegetables; marketing, quality assurance and legislation.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Importance and status of post harvest horticulture in Nepal; commercial post harvest procedures – an integrated strategy	1
2.	Constraints in the development of post harvest enterprises	1
3.	Causes of post harvest deterioration; physical, physiological and pathological	1
4.	Basic differences in the physiology of attached and detached organs	1
5.	Post harvest physiology : Transpiration; Respiration; Ethylene production; Ripening of fruits and vegetables	5
6.	Factor affecting physiological activity of harvested organs	1
7.	Maturity indices of horticultural commodities	1
8	Packing house operation; Cleaning, grading, sizing, curing, waxing, pre-cooling and degreening	3
9.	Post harvest commodity profiles	
	Vegetables : Leaf and stem vegetables; Cole crops; Cucurbits; Leguminous; Solanaceous; Roots and bulb crops	1
	Fruits : Tropical and subtropical (banana, citrus, mango, pineapple, papaya, litchi); Temperate (apple, pear, plum and soft fruit)	2
	Flower : Pot flower; Cut flower	1
10	Post harvest diseases and their control	1
11	Post harvest insect pest and their control	1
12	Physiological disorders, their causes and preventive measures	1
13	Market and marketing systems of perishable commodities	1
14	Status and problems of marketing of horticultural produce in Nepal	1
	Principles and methods of storage	2
15.	Post harvest handling, packaging and transportation	1
16	Preservation of fruits and vegetables	2
17.	Quality of produce and its evaluation	1
18.	Legislation: Implications of legislation on production and marketing of fresh horticultural produce for local and export markets; Current legislation in Nepal	1
	Total	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Identification of tools and equipment used in post-harvest horticulture	1

2.	Study of temperature and relative humidity	1
3.	Determination of total soluble solids and tritable acidity	1
4.	Maturity judgment and harvesting of fruits and vegetables	1
5.	Artificial ripening of fruits	1
6.	Degreening of oranges	1
7.	Survey of market to find out various problems	1
8.	Development of proposal for post-harvest enterprises	1
9.	Preparation of jam	1
10.	Preparation of jelly or marmalade	1
11.	Preparation of tomato ketchup	1
12.	Preparation of pickles	1
13.	Drying or dehydration of fruits and vegetables	1
14.	Waxing of citrus fruits	1
15.	Post-harvest treatments for disease control and shelflife/marketing	1
	Total	15

REFERENCES

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

Pantastico, Er. B. (ed). 1975. Postharvest physiology, handling and utilization of tropical and subtropical fruits and Vegetables. The AVI Pub. Co. Connectcut Inc. Westport, Connecticut.

Wills, R.B.H, W.B. McGlasson, D. Graham, T.H. Lee and E.G. Hall 1996. Postharvest: An Introduction to Physiologyand Handling of Fruits and vegetables. CBS Publishers and Distributors 4596/1A,11Dariyaganj, New Delhi 110002, India.

Course Code : PRW 311

Course Title : Horticulture Project Work

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

OBJECTIVES

The course will develop skill and confidence in basic cultural practices of major horticultural crops.

I. SYLLABUS

Vegetable production from seeding to marketing by students themselves. The students are required to prepare the proposal of crop production, execute the proposal and write up report independently and present orally the report to the Course Supervisor.

Course Code : WEP 111

Course Title : Work Experience Program

Credit Hours : 1 (0+1) Full Marks: 25 Theory: 0 Practical: 25

OBJECTIVES

This course is designed to inculcate in the students the dignity of work. The students will be required to accomplish various activities related to agriculture, society, sanitation, landscaping, environment protection, etc.

Course Code : WEP 121

Course Title : Work Experience Program

Credit Hours : 1 (0+1) Full Marks: 25 Theory: 0 Practical: 25

OBJECTIVES

This course is designed to inculcate in the students the dignity of work. The students will be required to accomplish various activities related to agriculture, society, sanitation, landscaping, environment protection, etc.

LIVESTOCK PRODUCTION AND MANAEMENT

Course Code : LPM 111
Course Title : Introductory Animal Science
Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES
The main objective of this course is to teach the students about importance of livestock and poultry industry; prevention and control measures of commonly occurring diseases and parasites of livestock and poultry.

I. SYLLABUS
Importance, scope, hinderances of livestock and poultry in Nepal. Zoological classification of farm animals and birds. Difference between ruminant and non-ruminant. Commonly used terms of animal husbandry. Ageing, weighing, identifications. Animal restraining and handling. Marketing and transportation. Sign of health and diseases. Care and management of sick animals. Control and prevention of major diseases and parasites (H.S., BQ, FMD, Brucellosis, Ranikhet, Fowl Pox, Coccidiosis, Gumboro disease, Marek's disease, Swine Fever, ticks, lice, Fleas, liverfluke, Ascariasis, tapeworm). Importance of barn sanitation and waste handling. Farm record.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Introduction, scope and constraints of livestock and poultry production, and terminology	2
2.	Zoological classification of farm animals and birds and their breeds	3
3.	Differences between ruminant and non-ruminants	3
4.	Aging, weighing, identification, animal restraining and handling	3
5.	Handling, marketing and transportation of farm animals	2
6.	Sign of health and diseases	2
7.	Care and management of new born and sick animals	3
8.	Control and prevention of major diseases and parasites eg. H.S., B.Q., FMD, Brucellosis, Ranikhet, Fowl Pox, Coccidiosis, Gumboro disease, Marek's Disease, Swine Fever, ticks, lices, fleas, liverfluke, Ascariosis, tapeworm	4
9.	Feeds, fodder and feeding	4
10.	Importance of barn sanitation and waste handling	2
11.	Farm records study, maintenance and preparation	2
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Study of livestock housing system	1
2.	Identification of external body points/parts of cattle, buffalo, sheep, goat,	2

	pig and poultry	
3.	Study of body temperature, respiration rate and pulse rate	1
4.	Cleaning and disinfection of the barn	1
5.	Aging by dentition of cattle, buffalo, sheep, goat and swine	2
6.	Estimation of body weight through body measurement	1
7.	Identification of different farm, animal and poultry breeds	1
8.	Numbering of farm animals and birds	2
9.	Study of different types of farm records	1
10.	Casting and handling of farm animals	1
11.	Differences between layers and loafers of poultry breeds	1
12.	Identification of feed ingredients and fodder	1
	Total:	15

REFERENCES

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

Banerjee, G.C. 1995. Poultry. Oxford and IBH Publishing, New Delhi (3rd Edition).

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

Ranjhan, S.K. 1993. Animal Nutrition in the tropics; Vikash Publishing House Pvt. Ltd. India.

Course Code : LPM 121

Course Title : Ruminant Production

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

OBJECTIVES

Upon successful completion of the course students will be able to recognize different breeds of cattle, buffalo, sheep and goats and to rear ruminant animals.

I. SYLLABUS

Breeds of cattle buffalo, sheep and goat (Hariana, Sahiwal, Sindhi, Brown Swiss, Jersey, HF, Siri, Murrah, Jaffarabadi, Nili-Rabi, Surti, Lime/Merino, Rambouillet, Rommey, Polworth, Bhyanglung, Kage, Baruwal, Lampuchhre/Khari, Jammunapari, Beetal, Barbari, Sannen). Care and management of cattle, buffalo, goat and sheep. Housing principles and types of housing for ruminants. Artificial rearing of newborn. Feeds and feeding of ruminants. Castration, dehorning, grooming, dipping, dusting, shearing. Judging and selection. Use of draft animals. Milking methods.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Introduction, scope and statistics of ruminants	1
2.	Breeds and characteristics of buffalo	1
3.	Breeds and characteristics of cattle	1
4.	Breeds and characteristics of sheep	1
5.	Breeds and characteristics of goat	1

6.	Care and management of cattle, buffalo, sheep and goats	2
7.	Housing principles and housing of ruminants	1
8.	Artificial rearing of newborn ruminants	1
9.	Castration, dehorning, grooming, dipping, dusting and shearing	2
10.	Judging and selection	2
11.	Use of draft animals	1
12.	Milking methods	1
	Total:	15

B. Practicals

S.N.	Topic	No. of Practicals
1.	Study animal housing at different farms	2
2.	Castration of bull, goat and ram	3
3.	Dehorning of buffalo and cattle	3
4.	Grooming of cattle and buffalo	2
5.	Cleaning the barn and milking parlour	2
6.	Milking practices	2
7.	Identification of feeds and fodder	1
	Total:	15

REFERENCES

Banerjee, G.C. 1991. A textbook of animal husbandry. Oxford and IBH Publishing, New Delhi (7th Edition).

Banerjee, G.C. 1995. Poultry. Oxford and IBH Publishing, New Delhi (3rd Edition).

Ranjhan, C.K. and N.N. Pathak. ..... Textbook on buffalo production. Vikas Publishing House Pvt. Ltd., New Delhi.

Course Code : LPM 211

Course Title : Pig and Poultry Production

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

OBJECTIVES

This course will enable the students to gain knowledge on scientific rearing methods of pigs and poultry birds.

I. SYLLABUS

Prominent breeds of pig. Care, management and feeding of different age groups. Housing: Systems, materials and essentials. Commonly used managemental practices. Prominent indigenous and exotic commercial breeds of broiler and layers. Rearing and feeding essentials of broiler and layers of different groups. Housing system: requirements and materials and design. Egg formation, selection of eggs for incubation. Factors essential for best hatching . Brooding methods. Common managerial practices. Vaccination, debeaking, candling, sexing, selection, grading of eggs. Selection and culling of layers. Biosecurity in a commercial farm.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Introduction, scope and statistics of pig and poultry	1
2.	Care and management of newborn piglets	1
3.	Care and management of pregnant sow and breeding boar	1
4.	Housing systems, materials and essentials for housing	2
5.	Commonly used management practices of poultry	1
6.	Breeds of pig and poultry (broilers, layers and dual purpose)	1
7.	Materials and design of poultry housing	1
8.	Egg formation, selection of eggs for table purpose and incubation	3
9.	Factors essential for best hatching	1
10.	Brooding methods (natural and artificial)	1
11.	Common managerial practices for broilers and layers	1
12.	Biosecurity in a commercial farm	1
	Total:	15

B. Practicals

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

REFERENCES

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 (3rd Edition).

Course Code : LPM 421

Course Title : Introduction to Dairy Science

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

OBJECTIVES

Upon the completion of this course, students will be able to determine the milk constituents and get acquaintance with mammary gland, milk letdown and standardization of milk.

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. Flavour 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. Lectures

S.N.	Topic	No. of Lectures
1.	Introduction to course outlines and evaluation system; Dairying in Nepal, its scope and comparison with developed countries	3
2.	Milk : Definition of milk and diagrammatic representation of milk constituents; Composition of milk in brief (fat, lactose, protein, enzymes, vitamins and minerals) ; Nutritive value of milk; Physical and chemical properties of milk; Factors affecting the composition of milk	10
3.	Physiology of lactation: Mammary gland and hormones related to development of udder; Milk secretion and letdown of milk	4
4.	Milking: (a) Hand and machine milking methods; (b) Clean milk production, importance and factors affecting the clean milk production	4
5.	Flavours and off-flavours of milk: Flavour defects in milk and their prevention measures in brief	4
6.	Dairy microbiology: Types of M.O. found in milk, their sources of contamination, uses and significance of micro-organism in Dairy Industry.	5
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Study of commonly used dairy equipments in Lab.	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 SP. gr. SNF and T.S. in milk	2
6.	COB and titrable acidity test in milk	2
7.	Study of MBR test for assessing microbiological quality	3
8.	Study of mammary gland and physiology of lactation	1
9.	Study of correct method of hand milking	1
10.	Estimation of M.O. by using microscope and CMT paddle	2
	Total:	15

REFERENCES

Clarence, H.E., W.B. Combs and H. Macy. 1994. Milk and milk products. TATA, McGraw-Hill Publishing Company Ltd., India.

Prasad, J. 1997. Animal husbandry and dairy science. Kalyani Publishers, India.

Sukumar, De. 2000. Outlines of dairy technology. By Oxford University Press, New Delhi, India. pp 1-359.

Course Code : PRW 311
Course Title : Project Work
Credit Hours : 2 (0+2) Full Marks: 50 Theory: 0 Practical: 50

OBJECTIVES
The course will develop skill and confidence in basic management practices of farm animals.

I. SYLLABUS
Farm animal management by the students themselves. The students are required to prepare the proposal of animal production and management, execute the proposal and write up report independently and present orally the report to the Course Supervisor.

PLANT BREEDING

Course Code : GEN 211
Course Title : Introductory Genetics
Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES
This course is designed to help students understand the science of genetics in terms of chromosomal characters and the principles of genetics, and solve the numerical problems related to inheritance of qualitative and quantitative characters.

I. SYLLABUS
Introduction, scope and history of genetics; cell structure and contents; cell division; life cycle; Mendelian genetics; laws of probability; gene action and interaction; linkage and crossing over; sex determination; extra-nuclear inheritance; nucleic acids; mutation; chromosomal aberrations; transposable genetic elements; gene regulation.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Introduction and scope of genetics	1
2.	History of genetics	1
3.	Cell division (mitosis, meiosis, and cell cycle)	2
4.	Life cycles (virus, bacteria, *Neurospora*, *Aspergillus*, maize, and man	3
5.	Mendel's laws of segregation and independent assortment	2
6.	Probability and statistical testing	1
7.	Gene action and interaction	2
8.	Sex determination and sex linkage	2
9.	Linkage and crossing over - 2 and 3 point cross and complex problems linkage map)	2
10.	Extra-nuclear inheritance - genes in organelles, maternal effect, criteria for extra-nuclear inheritance	2
11.	Nucleic acids - DNA, RNA, replication, transcription, translation, and genetic code	4
12.	Mutation - genic, chromosomal and molecular levels	2
13.	Chromosomal aberrations, euploidy, and aneuploidy	3
14.	Transposable genetic elements	1
15.	Gene regulation	2
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Study of diagrams of mitosis	1
2.	Study of diagrams of meiosis	1
3.	Microscopic study of different stages of mitosis	2

4.	Microscopic study of different stages of meiosis	2
5.	Field demonstration of segregation	2
6.	Field demonstration of independent assortment	2
7.	Field demonstration of gene interaction	1
8.	Study of three-dimensional view of DNA	1
9.	Study of three-dimensional view of RNA	1
10.	Field demonstration of cytoplasmic/genetic male sterility	1
11.	Linkage analysis of *gamadiness* genes in rice	1
	Total:	15

REFERENCES

Davern, C.I. 1981. Genetics. Readings from Scientific American. W.H. Freeman and Co., USA .

Remirez, D.A. 1991. Genetics. (7th Ed.). SEAMEO-SEARCA, UPLB, Philippines.

Suzuki, D.T., A.J.F. Griffith, J.H. Miller, and R.C. Lewontin. 1986. An Introduction to Genetic Analysis. (3rd Ed.). W.H. Freeman and Co., USA.

Course Code : GEN 311

Course Title : Genetics of Populations

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

OBJECTIVES

The main objective of this course is to teach the students about the fine structure of genes, how gene controls phenotypic expression, the principles of developmental genetics, the genetic control mechanisms of quantitative characters, and the concept of genotype-by-environmental interactions.

I. SYLLABUS

The nature of gene; manipulation of DNA; genetic control mechanisms in eucaryotes; developmental genetics; quantitative genetics; genotype-by-environment interaction; population genetics.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	The nature of gene (one gene one polypeptide hypothesis, enzymatic explanation of genetic ratios, and genetic fine structures)	4
2.	Manipulation of DNA (location and isolation of DNA, restriction enzymes, RFLP, formation of recombinant DNA, vectors, methods of cloning, and LOD score)	8
3.	Chromosome and genetic control mechanism in eucaryotes	5
4.	Developmental genetics (variegation in biological tissues, development and pattern, genetics of cancer and immunogenetics)	6
5.	Quantitative genetics (Johanssen's pureline theory, polygenes in discontinuous traits, and heritability)	2
6.	Genotype-by-environment interaction	2
7.	Population genetics (Hardy-Weinberg law, natural forces affecting	3

	equilibrium, inbreeding, and heterosis, genetic structure of populations and evolution)	
	Total:	30

REFERENCES

Davern, C.I. 1981. Genetics. Readings from Scientific American. W.H. Freeman and Co., USA.

Remirez, D.A. 1991. Genetics. (7th ed.). SEAMEO-SEARCA, UPLB, Philippines.

Sinott, E.W., L.C. Dunn, and T. Dobzhansky. 1985. Principles of Genetics. (5th ed.). Tata McGraw Hill Co. Ltd., India.

Strickberger, M.W. 1985. Genetics. (3rd Ed.). Macmillan Publ., Co., USA.

Suzuki, D.T., A.J.F. Griffith, J.H. Miller, and R.C. Lewontin. 1986. An Introduction to Genetic Analysis. (3rd ed.). W.H. Freeman and Co., USA.

Course Code : PLB 221

Course Title : Introductory Plant Breeding

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

OBJECTIVES

This course is focussed to the basic concept of plant breeding and its relationships with other disciplines, and to relate the principles of genetics to crop improvement.

I. SYLLABUS

Scope and history of plant breeding; plant introduction and domestication; modes of reproduction; inheritance of qualitative and quantitative characters; biometrical techniques; selection and hybridization in crops; heterosis; mutation breeding; polyploidy; release of new cultivars; crop improvement in Nepal; intellectual property right; plant breeding institutions.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Introduction to plant breeding (definition, history, objectives, activities, achievements, constraints, opportunities)	1
2.	Domestication, plant introduction, and acclimatization (domestication, evolution, germplasm, gene pool, centers of origin, collection, conservation, utilization, acclimatization, introduction	2
3.	Modes of reproduction and pollination control (modes, inbreeders vs outbreeders, anthesis, pollination, incompatibility, male sterility)	2
4.	Qualitative and quantitative characters (qualitative and quantitative characters in crops and their inheritance)	1
5.	Biometrical techniques in plant breeding (assessment of variability, aids to selection, choice of parents, crossing techniques, genotype-by-environment interactions)	1
6.	Selection in self-pollinated crops (progeny test, pureline theory, origin of variation, genetic advance, genetic gain)	1
7.	Hybridization techniques and its consequences (objectives, types, program, procedures, consequences)	1

8.	Genetic composition of cross-pollinated populations (Hardy-Weinberg law, equilibrium, mating systems)	1
9.	Selection in cross-pollinated crops (response and gain from selection, variability)	1
10.	Heterosis and inbreeding depression (effects of inbreeding, inbreeding depression, heterosis and its genetic and physiological basis, utilization and fixation of heterosis)	1
11.	Mutation breeding (types, use of matagens, application)	1
12.	Polyploidy in plant breeding (aneuploidy, euploidy, allo- and autoploidy, applications)	2
13.	Breeding methods in self-pollinated crops (Mass, Pureline, Pedigree, Bulk, Backcross, etc)	2
14.	Breeding methods in self-pollinated crops (Population improvement, Hybrid production, Synthetics)	2
15.	Clonal selection and hybridization	1
16.	Release of new varieties	1
17.	Quality seed	1
18.	Crop improvement of in Nepal (Rice, heat, Maize, Legumes, Oilseeds, Millets, vegetables, fruits and others)	5
19.	Breeding for pest resistance	1
20.	Intellectual property right	1
21.	Plant breeding organizations	1
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Review, study and draw floral parts of field crops	2
2.	Hybridization of crops available in the field	5
3.	Plant breeding data recording	1
4.	Determining genetic purity of seed in the lab	1
5.	Maintaining genetic purity in the field	1
6.	Scoring data and determining resistance/susceptibility to pests	2
7.	Describing the traits for release of a new variety	1
8.	Study of the activities at Maize Research Program	1
9.	Study of the activities at Grain-legume Research Program	1
	Total:	15

REFERENCES

Singh, B.D. 2000. Textbook of plant breeding. (1st Ed.). Kalyani Publishers, New Delhi.
Strickberger, M.W. 1985. Genetics. (3rd Ed.). Macmillan Publ., Co., USA.

Course Code : BIT 411
Course Title : Introductory Biotechnology and Biodiversity
Credit Hours : 2 (2+0) Full Marks: 50 Theory: 50 Practical: 00

OBJECTIVES

This course will provide students about the basic concepts of biotechnology and biodiversity.

I. SYLLABUS

Biotechnology – Overview, history and scope; genetic engineering and gene cloning in plants and animals; cell and tissue culture in plants and animals; different uses of biotechnology.

Biodiversity – Concept, aim and scope; classification and nomenclature; indexing; diversity in plants, animals, and microbes; techniques to study diversity; centers of genetic diversity; conservation of biodiversity.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
Biotechnology		
1.	An over view of biotechnology – history, process and product	1
2.	Genetic engineering and gene cloning	2
3.	Gene transfer mechanisms in bacteria	1
4.	Transferring genes into plants and animal cells	2
5.	Plant cell and tissue culture	2
6.	Animal cell and tissue culture	2
7.	Agricultural biotechnology	1
8.	Industrial biotechnology	1
9.	Healthcare biotechnology	1
10.	Environmental biotechnology	1
11.	Biotechnology and ethics	1
Biodiversity		
12.	The concept, aim and, scope of biodiveristy	3
13	Diversity, classification, and nomenclature of cultivated plants, weeds, microbes, and insect-pests	5
14.	Indexing biodiversity	2
15.	Centers of diversity of crops and wild genetic diversity	2
16	Conservation of biodiversity – current practices; national legislation and international conventions and treaties, and biodiversity prospects and intellectual property rights	3
	Total:	30

REFERENCES

Chaudhary, R.P. 1998. Biodiversity in Nepal: Status and Conservation. S. Devi, Sharranpur, India

Ignacimuthu, S. 1996. Basic Biotechnology. Tata McGraw-Hill Publishing Company Limited

Jha, P.K., G.P.S. Ghimire, S.B. Karmacharya, S.R. Baral, and P. Lacoul. 1996. Environment and Biodiversity. ECOS (Nepal), Kathnamdu, Nepal.

Shrestha, T.B. 2000. Nepal Country Report on Biological Diversity. IUCN-Nepal

PLANT PATHOLOGY

Course Code : PLP 311

Course Title : Introduction to Plant Pathology

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

OBJECTIVES

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

I. SYLLABUS

Introduction to the basic principles of plant pathology, causes, survival, dissemination, and epidemiological studies, defense mechanisms, toxins and the physiology of infected plants; Importance and classification of fungi, their asexual and sexual reproduction; General characters of fungal, bacterial, nematode and viral pathogens.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Introduction and definition of plant pathology and plant diseases	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	1
5.	Classification of fungi with their diagnostic characters	1
6.	Myxomycota: *Plasmodiophora* and *Spongospora*	1
7.	Mastigomycotina: *Synchytrium, Pythium, Phytophthora, Albugo, Sclerospora, Plasmopara,* and *Peronosora*	2
8.	Ascomycotina: *Taphrina, Protomyces, Erysiphe, Claviceps*	2
9.	Basidiomycotina: *Puccinia, Melampsora, Uromyces, Ustilago,* & *Tilletia*	2
10.	Deuteromycotina: *Colletotrichum, Alternaria, Cercospora, Fusarium, Helminthosorium,Pyricularia, Sclerotium, Sclerotinia, Rhizoctonia*	3
11.	Definition, general morphology of bacterial cell and their functions	1
12.	Classification, and Characteristics of *Xanthomonas, Psedomonas, Erwinia, Agrobacterium, Corynebacterium* and *Streptomyces*	1
13.	Virus ,Mycoplasma and Spiroplasma; definition and general characters	1
14.	Multiplication and transmission of virus	1
15.	General characteristics , Life cycle and reproduction of nematode	1
16.	Characteristics of *Anguina, Heterodera, Meloidogyne* and *Hirshmaniella*	1
17.	Pathogenecity and Pathogenesis	1
18.	Survival and dissemination of plant pathogens	2
19.	Epidemiological study	1
20.	Pre exposed and post exposed defense mechanisms	1
21.	Physiology of infected plants	1
22.	Enzymes, microbial toxins	1
23	Disease forecasting and principles of disease management	2
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Study about microscope	1
2.	Differentiation between abiotic and biotic plant diseases	1
3.	Cleaning and sterilization of glasswares	1
4.	Preparation of PDA tube and plate	2
5.	Isolation of fungi from diseased plant and soil	2
6.	Identification of fungi	2
7.	Calibration and measurement of fungal spores	1
8.	Media preparation for bacteria isolation	1
9.	Isolaiton of bacteria	1
10.	Identification of Grahm +ve and –ve bacteria	1
11.	Extraction of nematode from soil	1
12.	Identification of pathogenic and saprophytic nematode	1
	Total:	15

REFERENCES

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

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

Singh, R.S. 1999. Introduction to Principles of Plant Pathology (3rd Ed.). Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

Course Code : PLP 321

Course Title : Crop Diseases and their Management

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

OBJECTIVES

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

I. SYLLABUS

Fungal diseases – powdery mildews, downy mildews, damping off of seedlings, root rots, collar rot, rusts, smuts, wilts, blights, blast, leaf spots, anthracnose, malformation, die-back, white rust, white stem blight. Bacterial diseases – leaf blight, leaf streak, wilt, angular leaf spot, canker, brown rot. Nematological diseases – root knot, cyst, white tip, tundu. Viral and Mycoplasmal diseases – mosaic, yellow vein, bunchy top, tristeza, greening, little leaf. Non-pathogenic diseases – tip burn, black heart, black tip, khaira.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Powdery mildew of pea, cucurbits, wheat and apple	2
2.	Downy mildew of maize, grape, crucufers and cucurbits	2
3.	Damping off of seedlings, root rot and collar rot of citrus, papaya, and jute	2
4.	Rusts of wheat, pea and beans	1
5.	Loose smut and bunt of wheat, covered smut of barley	1
6.	Wilts of guava, cotton, arhar, lentil and chickpea	1
7.	Late blight of potato and tomato, mango malformation	1
8.	Blast and leaf spot of rice, leaf blotch of wheat	1
9.	Alternaria leaf spot of and blight of *Brassica*, leaf spot of groundnut	1
10.	Anthracnose of bean, die-back and leaf spot of chilli	1
11.	Stem gall of coriender, peach leaf curl and ergot of bajra	1
12.	White rust of Crucifers, Sclerotinia blight of Solanaceous crops	1
13.	Red rust of tea, lichi rust and guava rust	1
14.	Bacterial leaf blight and leaf streak of paddy, angular leaf spot of cotton	1
15.	Black rot of cole crops and Stalk rot of maize	1
16.	Citrus canker and brown rot of potato	1
17.	Root knot of vegetables and rice	1
18.	Ear cockle of wheat, golden nematodes of potato	1
19.	White tip of paddy, cyst nematodes	1
20.	Yellow vein of okra, tobacco and tomato mosaic, papaya mosaic	1
21.	Bunchy top of banana and tristeza virus of citrus	1
22.	Virus diseases of potato	1
23.	Bean common mosaic virus, soybean mosaic	1
24.	Little leaf of brinjal and chilli, churki and furki disease of cardamom	1
25.	Tip burn of paddy, black heart of potato	1
26.	Khaira disease of rice, black tip of mango	1
27.	Orobanche on Crucifers and Solanaceous crops	1
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Field visits to identify the fungal, bacterial, viral, nematological and non-pathogenic diseases of the crop plants	1
2.	Collection and preservation of disease specimens	1
3.	Preparation of temporary slides of fungi	1
4.	Teasing of infected samples to find out the causal organisms and their identification	2
5.	Transverse section cutting of disease specimens to study the host-parasite relationship	5
6.	Ooze test for bacterial infection	1
7.	Study of the root knot nematode	1
8.	Dilution of the chemicals	1
9.	Handling and calibration of sprayer	1
10.	Preparation of Bordeaux mixture	1
	Total:	15

REFERENCES

Agrios, G.N. 1997. Plant Pathology (4th Ed.). Harcourt Asia Pvt. Ltd.

Dasgupta, M.K. 1998. Phytonematology. Nara Prokash, Calcutta, India.

Mehotra, R.S. 1980. Plant Pathology. Tata Mc Graw-Hill Publishing Company Ltd. New Delhi.

SOIL SCIENCE AND AGRICULTURAL ENGINEERING

Course Code : SSC 111
Course Title : Fundamentals of Soil Science and Geology
Credit Hours : 3 (2+1) Full Marks: 75 Theory: 50 Practical: 25

OBJECTIVES

Upon the successful completion of this course, the students will be able to gain basic knowledge of soils in relation to crop production, physical and chemical properties of soils, and be able to identify soil reactions for the amendments of different types of soil condition.

I. SYLLABUS

Definition, concept and use of soils; soil as a medium for plant growth; soil components and soil-plant relationship; physical properties of soils – mechanical composition and textural classification, soil structure and its importance, soil color and its importance, bulk density, particle density and porosity of soils, consistence and plasticity; soil reaction-pH and measurements, soil acidity and alkalinity, effect of pH on nutrient availability, buffering of soils; amendments of acid, saline and sodic soils; Soil colloids – organic and inorganic colloids and their properties; cation and anion exchange phenomena; silicate clays – composition and properties. Geology in relation to soils-evolution and composition of earth, development of soils; rocks and minerals- origin, classification, distribution and weathering; geogical behaviour of elements, fluvial, glacial, marine and lacustrine land forms, geology and soils of physiographic units of Nepal.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Soils that support: Definition, concept and uses of soils Soil as natural body and medium for plant growth History of soil science Soil-plant relations	4
2.	Soil components: Physical – solid, liquid and gases Mineralogical – soil forming rocks and minerals	5
3.	Physical properties of soils: Soil textural classification. Soil structure and its importance Bulk density, particle density, porosity, soil consistency, plasticity, soil color, adhesion, cohesion and their importance in agriculture	5
4.	Chemical properties of soils: (a) Soil reaction: Soil pH, soil acidity, buffering and liming Saline, sodic soils and their properties and management Soil pH and nutrient availability	5

	(b) Soil colloids: Inorganic and organic colloids Silicate clays and their genesis and properties. Cation and anion exchange phenomena.	5
5.	Geology in relation to soils: Evolution and composition of earth Rocks and minerals. Geological behavior of elements Land forms Geology and physiographic units of Nepal	6
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Study of soils as natural body.	1
2.	Soil sampling, tools, collection of representative samples, processing and storage.	1
3.	Soil textures and consistency determination by feel method.	2
4.	Particle size analysis by Hydrometer method.	2
5.	Determination of soil structure.	1
6.	Determination of soil bulk density and porosity.	2
7.	Determination of soil color.	2
8.	Determination of soil pH and lime requirement in acid soils.	2
9.	Determination of electrical conductivity.	1
10.	Identification of major soil forming rocks and minerals	1
	Total:	15

REFERENCES

Brady, N.C. 1990. The nature and properties of soils. New York: Macmillan Publishing Company.

Chopra, S.L. and J.S. Kanwar. 1999. Analytical agricultural chemistry. Kalyani Publishers, Ludhiana, India:.

Foth, H.D. 1984. Fundamental of Soil Science. John Wiley and Sons, New York

Miller, R.W. and R.L. Donahue. 1995. Soils in our environment. Prentice Hall, Englewood Cliffs N.J., USA.

Singer, M.J. and D.N. Munns. 1991. Soils – An introduction. New York: McMillan Publishing Company.

Course Code : 121

Course Title : Soil Fertility, Fertilizers and Integrated Nutrient Management

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

OBJECTIVES

Upon the successful completion of this course, the students will be able to gain basic knowledge of soils in relation to different types of fertilizers; evaluate the soil fertility status, describe the significance of organic matter and biofertilizers in crop production.

I. SYLLABUS

Historical Development of soil fertility and plant nutrition; essential plant nutrients – primary, secondary and micronutrients: their sources, functions, deficiency symptom and availability to plant; fertilizers – their composition, uses and behavior in soils; biofertilizers and their usage; prospects of biogas plant in Nepalese agriculture; soil organic matter; types of organic manures and their preparation; green manuring; soil fertility evaluation – visual diagnosis, plant analysis and tissue tests, biological tests and soil tests; integrated nutrient management; soil fertility problems in Nepal; soil management for sustainable agriculture.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Historical development of soil fertility and plant nutrition.	1
2.	Essential plant nutrients: (a) Criteria for nutrient essentiality for plants. (b) Primary essential nutrients – sources, function, deficiency symptoms, and availability to plants. (c) Secondary essential nutrients - sources, function, deficiency symptoms, and availability to plants. (d) Micronutrients - sources, function, deficiency symptoms, and availability to plants.	8
3.	Fertilizers: (a) Nitrogenous fertilizers - their composition, uses and behavior in soils. (b) Phosphatic fertilizers - their composition, uses and behavior in soils. (c) Potassic fertilizers - their composition, uses and behavior in soils.	7
4.	Soil organic matter and organic manures: Organic matters and their importance. Organic manures and their preparations. Biofertilizers and green manuring. Biogas and its importance in Nepal.	4
5.	Soil fertility evaluation: Visual diagnosis. Plant and tissue analysis. Biological methods. Soil tests.	3
6.	Integrated nutrient management: Concept and relevance. Components. Management options.	3
7.	Soil fertility problems: Problems of soil fertility in Nepal and their management. Effects of continuous use of inorganic and organic nutrient sources on soil fertility.	2
8.	Soil management for sustainable agriculture	2
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Identification and functions of laboratory equipments	1
2.	Chemical calculations and preparations of solutions of various strengths and standard curves	1
3.	Soil and plant sampling and their preparations for analysis	1
4.	Use of kit box for different analysis in soils	1
5.	Determination of pH in soils	1
6.	Basic principles of Kjeldahl distillation, spectrophotometer, and flame photometer	1
7.	Collection and identification of nutrient deficiency symptoms on major crops in and around IAAS Farm	1
8.	Determination of different forms of nitrogen in soils	2
9.	Determination of available phosphorus in soils	2
10.	Determination of available potassium in soils	2
11.	Determination of organic matter in soils	2
	Total:	15

REFERENCES

Chopra, S.L. and J.S. Kanwar. 1999. Analytical Agricultural Chemistry. Kalyani Publishers, Ludhiana, India.

Foth, H.D. and B.E. Ellis. 1997. Soil Fertility. New York: Lewis Publishers.

Jones, U.S. 1979. Fertilizers and Soil Fertility. Reston Publishing Company, Virginia. USA.

Prasad, R. and J.F. Power. 1977. Soil Fertility Management for Sustainable Agriculture. Lewis Publisher, New York, USA.

Tisdale, S.L., W.L. Nelson and J.D. Beaton. 1990. Soil fertility and fertilizers. Macmillan Publishing Company, New York, USA.

Course Code : SSC 221

Course Title : Soil Physics, Genesis and Classification

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

OBJECTIVES

Upon the successful completion of this course, the students will be able to gain basic knowledge of soils in relation to soil environment, soil characteristics and their effect on soil management and plant growth.

I. SYLLABUS

Potential energy of water, its movement across soil-plant-atmosphere continuum and measurement; Soil environment and transient conditions affecting water, air and hear flow; Infiltration and surface sealing in relation to soil characteristics and effect on plant growth; soil management through structural improvement; profile mixing, role of temperature and moisture regimes in soil classification, a brief account of USDA system of soil classification and FAO/UNECO systems.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Quantitative concept of soil physics	1
2.	Soil water energy concepts, and soil moisture characteristic curves	1
3.	Soil water movement under saturated and unsaturated conditions	1
4.	Air and heat movement in the soil, and Infiltration characteristics of soils	1
5.	Surface sealing, management and its effects on soils and crop growth	1
6.	Structural management in arable soils and soil conservation	1
7.	Weathering of rocks and minerals	1
8.	Horizons designation and micro-morphological properties of soil	1
9.	Surface and sub-surface diagnostic horizons	1
10.	Soil moisture and temperature regimes	1
11.	Soil classification on the basis of taxonomy	1
12.	FAO/UNESCO soil classification system	1
13.	Major soils found in Nepal and their land use	3
	Total:	15

B. Practicals

S.N.	Topic	No. of Practicals
1.	Analytical concepts	1
2.	Determination of soil wetness by gravimetric, volumetric and depth	1
3.	Volume and mass relationship of soil constituents	1
4.	Calculation of water quantities	1
5.	Measurement of matric suction by field tensiometer	1
6.	Measurement of water availability by resistance method	1
7.	Observation of capillary phenomenon of soil	1
8.	Aggregate analysis	1
9.	Review of morphological properties of soils in the lab	1
10.	Interpretation of aerial photographs for its use as a base map	1
11.	Demonstration and explanation of already developed different types and scales of soil maps and reports	1
12.	Description of soil profiles under distinctive landscapes and land-uses of IAAS farm soils and their interpretations for classification	2
13.	Procedures and development of soil maps of Nepal and reports	2
	Total:	15

REFERENCES

Brady, N.C. 1990. The Nature and Properties of Soils. Macmillan Publishing Company, New York, USA.

Brady, N.C. and R.R. Weil. 1999. The Nature and Properties of Soils (12th ed.). Prentice-Hall, Inc Pearson Education, New Jersey, USA.

Buol, S.W., F.D. Hole, and R.J. McCracken. 1980. Soil genesis and classification (2nd ed.). The Iowa State University Press.

Singh, R.A. 1980. Soil physical analysis. Kalyani Publishers, New Delhi – Ludhiyana.

Course Code : SSC 311
Course Title : Introductory Soil Conservation and Watershed Management
Credit Hours : 2 (2+0) Full Marks: 50 Theory: 50 Practical: 0

OBJECTIVES
Upon the successful completion of this course, the students will be able to gain basic knowledge of soils focussing to the basics of soil conservation and watershed management related principles and practices.

I. SYLLABUS
Hydrology and its related branches, hydrological cycle, importance and human influence; water: quality, water pollution, water samples; soil erosion: mechanics and forms of water erosion, erosivity and rainfall and runoff, types of water erosion; mechanics of wind erosion: processes, factors affecting, control measures; soil erosion monitoring and estimation: simple visual methods, runoff plot, sedimentation survey; consequences of soil erosion: fertility loss, land degradation, floods, landslides, natural hazards, socio-economic consequences; soil conservation practices: soil erosion control in agricultural lands, forestlands and rangelands, concept of watershed and watershed management; approach to soil conservation and watershed management in Nepal: legislation and regulations.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Hydrology and Hydrologic cycle Related branches of hydrology Importance of hydrologic knowledge in natural resources planning Human influence on hydrologic processes	3
2.	Measures of water quality Sources of water pollution Collection of water samples	2
3.	Mechanics and forms of water erosion Definition of soil erosion Erodivity of rainfall and runoff Factors influencing soil erodibility Types of soil erosion by water: splash, rill, sheet, gulley and stream channel erosion Landslide, landslip and mass movement	5
4.	Mechanics of wind erosion Wind erosion processes, their observation and assessment Factors affecting wind erosion Wind erosion control	3
5.	Soil erosion monitoring and estimation: Simple visual methods for soil erosion monitoring Runoff plot monitoring Sedimentation survey Emperical methods for soil loss estimation	4
6.	Consequences of soil erosion: Fertility loss and land degradation Floods, landslide and natural hazards	3

	On-stie and Off-site consequences Socio-economic consequences	
7.	Soil Conservation Practices: (a) Soil Erosion Control in Agricultural Lands Manuring and Fertilization Mulching Conservation tillage Strip-planting, cover crop management, countour farming (b) Soil Erosion Control in Forest and Rangelands: Afforestation Control grazing (c) Bio-engineering measures (d) Engineering Measures - Checkdams, Retaining wall, Water ways, Terracing, Embankment, Spurs, and Spillways	4
8.	Concept of Watershed and Watershed Management Definition of watershed and sub-watershed Watershed approach in soil and water management Concept of integrated watershed management	3
9.	Approach to Soil Conservation and Watershed Management in Nepal Institutional arrangement for soil conservation and watershed management Legislations and regulations related to soil conservation and watershed management Approach adopted by Department of Soil Conservation and Watershed Management	3
	Total:	30

REFERENCES

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

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

Murty, V.V.N. 1985. Land and Water Management Engineering. Kalyani Publishers, New Delhi.

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

Course Code : AMT 211

Course Title : Introductory Agrometeorology

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

OBJECTIVES

This course will aware students about atmospheric processes that produce weather and climate, elements of weather and climate, their variations and significance in agriculture, importance and use of agrometeorological forecasting in agricultural decision making, agroclimatic regionalization and crop zonation and agroclimatic modification.

I. SYLLABUS

Definition, scope and role in agriculture, relationship with other areas of agriculture, historical development and recent advancement; earth atmosphere: composition and structure; solar radiation: properties, solar constant, effects, measurement, significance in crop production; atmospheric temperature: diurnal and seasonal variations, measurement and significance in crop production; atmospheric pressure: gradient, isobar, measurement; wind: causes, speed and direction measurements, its significance in agriculture; humidity: concept, determination and significance in crop production; evaporation: factors affecting evaporation and transpiration rates, measurement of evapotranspiration demands of crops; precipitation: forms, measurement and significance in crop production; soil moisture: concept, significance in crop production; agrometeorological normals of various crops; microclimatic modification: significance and shelter belts; agroclimatic regionalization and crop zonation; human influence on climate: global warming, greenhouse effects on agriculture.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Introduction: definition, aim and scope of agrometeorology; role of Agrometeorology in agriculture; relationship of agrometeorology with other areas of agricultural sciences; historical developments and recent advancements in agrometeorology	2
2.	Earth atmosphere: composition, extent and structure	1
3.	Solar radiation: nature and properties of solar radiation, solar constant, effect of atmosphere on incoming solar radiation, measurement of solar radiation, significance of solar radiation in crop production	3
4.	Atmospheric temperature: diurnal and seasonal variation in temperature, measurement of ambient temperature, significance of solar radiation in crop production	2
5.	Soil temperature: diurnal and seasonal variations in soil temperature, measurement of soil temperature, significance of soil temperature in crop production	2
6.	Atmospheric pressure: pressure gradient and isobar, measurement of atmospheric pressure	1
7.	Wind: causes of wind, wind speed and direction, measurement of wind speed and direction, significance of wind in crop production	2
8.	Humidity: concept of saturation and vapour pressure, determinants of humidity, significance of atmospheric humidity in crop production	2
9.	Evaporation: factors influencing evaporation and transpiration rates, measurement of evaporation, estimation of actual evapotranspiration demand of crops	3
10.	Precipitation: forms of precipitaiton, measurement of rainfall, significance of rainfall in crop production	2
11.	Soil Moisture: concept of soil moisture balance, significance of soil moisture in crop production	2
12.	Agrometeorological normals for: rice, wheat, maize, potato, sugarcane, cotton, soybean, citrus and vegetable crops	2
13.	Micro-climate modification: importance and significance of microclimate modification in agriculture, wind modification and shelter-belts	2

14.	Agroclimatic regionalization and crop zonation	2
17.	Human influence on climate: global warming and green house effect and their expected effects on global agricultural production	2
	Total:	30

REFERENCES

Mavi, H.S. 1998. Introduction to agro-meteorology. Oxford and IBH Publishing Co. New Delhi.

Murthy, V.R.K. 1993. Practical manual in agricultural meteorology. Kalyani Publishers, New Delhi.

Rosenberg, N.J., B.L. Blad and S.B. Verma. 1983. The biological environment. John Wiley & Sons, New York.

Smith, C.P. 1975. Methods in agricultural meteorology. Elseier Scientific Publishing Co. Amsterdam.

Course Code : AEN 221

Course Title : Farm Power and Machinery

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

OBJECTIVES

Upon successful completion of this course, students will be able to know different sources of farm power and their utilization. The students will also learn to operate farm machines for crop production; learn the principle of operation of internal combustion engines, their care and maintenance, understand the operation and control of two-wheeled and four wheeled farm tractors.

I. SYLLABUS

Sources of farm power including human, animal, electrical, mechanical, biogas, micro-hydro, solar and wind; internal combustion engines: two-stroke and four-stroke cycle compression ignition (diesel) and spark ignition (petrol) engines; farm tractors and their management: types and suitability of farm tractors for Nepalese agriculture; tillage and tillage implements: operation and management of primary, secondary tillage implements, cultivators and cultivator tools, specialized tillage implements; sowing and planting machines: types of seeding mechanics, furrow openers, zero-till and reduced seed drills and planters, planting machines; plant protection equipments: manual, power operated and tractor drawn sprayers and dusters; harvesting machines: reaper, mower and combined harvester; threshing machines: wheat and rice threshing, multi-crop threshers; primary processing machines; farm electricity and electrical machines; water lifting machines and irrigation pumps; cost of operation of tractors and farm implements; testing and evaluation of farm machines.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Sources of Farm Power: Availability and limitations of different sources of farm power including human, animal, electrical, mechanical, bio-gas, micro- hydro, solar and wind. Assessment of energy demand and supply	2

	in Nepalese agriculture. Utilization of non-conventional energy resources in agriculture	
2.	Internal Combustion Engines: Classification and working principle 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 internal combustion engines (tractor engine)- air cleaning, cooling, fuel supply, lubrication and electrical. Care, maintenance and trouble shooting of internal combustion engines	6
3.	Farm Tractors and their Management: Types of farm tractors. Suitability of farm Tractors for Nepalese agriculture. Introduction to control system of tractors and Their care and maintenance, including power transmission, brake, steering, PTO, Differential and hydraulic system. Tractor hitch system and hydraulic control	3
4.	Tillage and Tillage Implements: Definition and objectives of tillage. Changing Views on tillage operations. Operation and management of primary tillage Implements- mould board plough, disk plough, one way and two way plough, rotary tillage tools and rotavators. Operation and management of secondary tillage implements- types of harrows, operation and maintenance of animal and tractor drawn disk harrows. Operation and management of cultivators and cultivation tools. Specialized Tillage Implements- chisel plough, sub-soiler,ridger, bund-former, puddler, leveller and planker	3
5.	Sowing and Planting Machines: Types of seeding machines. Metering mechanism For seed and fertilizer in seed drills and planters. Types of furrow openers used in seed drill and planting machines. Zero-till and reduced till seed drills and planters. Planting machines for sugarcane and potato. Machines for rice transplanting	2
6.	Plant Protection Equipment: Working principle and functions of sprayer and dusters. Manual, power operated and tractor drawn sprayers and dusters. Nozzles used in Sprayers and their selection. Repari, maintenance and safety precautions in handling Plant protection equipments	2
7.	Harvesting Machines: Harvesting machines for cereals. Working principle and components of Reaper, mower and combined harvester. Harvesting equipments for roots and tuber crops	2
8.	Threshing Machines: Classification and working principle of threshers. Components of wheat and rice threshing machines. Multi-crop threshers	2
9.	Primary Processing Machines: Machines for cleaning, sorting and grading of cereals, pulses and vegetable crops and their working principle	2
10.	Farm Electricity and Electrical Machines: Terminology and prospects of farm electricity use. Working principle and types of electric motors. Selection for farm use and care and maintenance of electric motors	2
11.	Water Lifting Machines and Irrigation Pumps: Traditional water lifting devices. Reciprocating pump, axial flow and mixed flow pump, centrifugal pump. Pump selection and installation. Repair and maintenance of pumps. Types of prime movers and drivers	2
12.	Cost of operation of tractors and farm implements	1
13.	Testing and Evaluation of Farm Machines: Selection of farm machines and Implements. Field performance efficiency	1
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Identification and use of repair and maintenance tools	1
2.	Identification of machine elements	1
3.	Study of country plough and mould board plough	1
4.	Study of disk plough	1
5.	Study of harrow and cultivators	1
6.	Study of rotary tillage tools	1
7.	Study of seed drill, planters and their calibration	1
8.	Identification, maintenance and calibration of plant protection equipment	1
9.	Study of crop harvesting machines	1
10.	Study of threshers	1
11.	Identification of component parts, maintenance and study of engine systems	2
12.	Study of tractor systems, controls and maintenance	2
13.	Tractor and power tiller operation	1
	Total:	15

REFERENCES

Jagdishwar S. 1981. Elements of agricultural machinery. Agro Book Agency, Patna

Michael, A.M. and T.P. Ojha. 1988. Principles of Agricultural Engineering (Vol. I). Jain Brothers, Bhopal, India.

Nakra, C.P. 1980. Farm machines and equipments. Dhanpat Rai and Sons, New Delhi.

Srivastava, A.C. 1990. Elements of farm machinery. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Course Code : AEN 411

Course Title : Principles and Practices of Farm Water Management

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

OBJECTIVES

Upon completion of this course, the students are expected to know the importance of irrigation and water management for agricultural intensification and productivity enhancement; understand crop-water relationship and the procedure for irrigation scheduling, and learn the basic design principles of farm irrigation methods.

I. SYLLABUS

Irrigation: definition, objectives, roles in agriculture; need and initiatives for irrigation development in Nepal: status and performance, climatic condition, water resource potential, irrigated agricultural systems; soil-water-plant relationship: soil physical properties, soil moisture regimes, rooting characteristics, moisture stress and crop response, critical stages of crops; crop water requirement: evapotranspiration and consumptive use, field water losses; irrigation scheduling: objectives and strategies, soil, plant and climatic indicators; farm irrigation: methods, suitability, adaptability and comparative advantages of irrigation methods; land and soil management for irrigation: land grading and layout, soil and fertility management, soil reclamation; field drainage systems: water logging, drainage needs, methods of drainage systems; irrigation wells and pumps: groundwater occurrence and

utilization, types of irrigation wells, dugwells, tube-wells and shallow, tube-wells, water-lifting devices and irrigation pumps.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Introduction: Definition and objectives of irrigation Role of irrigation in agricultural development	1
2.	Need and Initiatives for Irrigation development in Nepal: Status and performance of Nepalese agriculture Climatic condition and need for irrigation Water resources potential of Nepal Initiatives for irrigation development in Nepal and performance of irrigated agricultural system	1
3.	Soil-Water-Plant Relationship: Physical properties of soil in relation to irrigation Soil water retention and movement Soil moisture regimes and their responses to crops Rooting characteristics and moisture extraction pattern Moisture stress and crop response Critical stages of crops for soil moisture	4
4.	Crop Water Requirement: Evapotranspiration and consumptive use Types of field water losses Crop water requirement and farm water requirement	3
5.	Irrigation Scheduling: Objectives and strategies of irrigation scheduling Soil, plant and climatic indicators for irrigation scheduling Crop planning, irrigation water delivery (continuous, rotational and demand based)	2
6.	Farm Irrigation Methods: Methods of farm irrigation (check basin, controlled flooding, border-strip, Furrow, sprinkler, trickle, sub-surface irrigation) Suitability, adoptability and comparative advantage of above irrigation method	5
7.	Land and Soil Management for Irrigation: Land grading and farm layout Soil and fertility management for irrigation Reclaimation of problem soils	2
8.	Filed Drainage System: Causes and consequences of water logging Investigation of water logging conditions and assessment of drainage needs Methods and selection of field drainage systems	3
9.	Irrigation Wells and Pumps: Occurrence and utilization of ground water for irrigation Types of irrigation wells- dug-well, tube-well, shallow and deep tube-wells)	4

	Water lifting devices and irrigation pumps	
10.	Conveyance, Control and Measurement of Irrigation Water: Types and Structural components of irrigation system Sizing of open channels for given stream flow Water control structures: check gates, turnouts, division boxes, inverted syphon, cultivars, flumes drop structure, chute-spillway etc. Measurement of irrigation water- float, weirs, flumes, orifices, current meter	4
11.	Environmental Consequences of Irrigation	1
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Measurement of soil moisture using gravimetric method and feed and appearance method	2
2.	Determination of soil moisture constants, field capacity and permanent wilting point	2
3.	Measurement of infiltration capacity of soil	2
4.	Determination of evapotranspiration by using climatic data	2
5.	Assessment of field water losses, seepage, percolation and runoff	1
6.	Evaluation of water application efficiencies and water distribution uniformity	1
7.	Study and design of different farm irrigation systems (surface-furrow, check basin; sprinkler; trickle and sub-surface)	2
8.	Measurement of flow of water in open channel using Float method Flow measuring devices – weirs, flumes, orifices	2
9.	Field visit to irrigation management	1
	Total:	15

REFERENCES

FAO. 1995. Training manuals on irrigation water management, FAO.

Michael, A.M. 1990. Irrigation: Theory and practice. Vikash Publishing House, New Delhi.

Murty, V.V.N. 1985. Land and water management engineering. Kalyani Publishers, New Delhi.

Course Code : AEN 421

Course Title : Farm Structure and Surveying

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

OBJECTIVES

The main objective of this course is to enable the students to prepare and interpret maps/plans, and to gain skill of land measurement, surveying, land grading and farm layout. The students will also learn about farmstead planning and construction of farm structure.

I. SYLLABUS

Surveying: definition, classification, units of measurements, scale, conventional signs; chain survey: linear measurements; 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; farm structures: 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, centring 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, types of dairy cattle house; design of feed, fodder and grain storage structure; estimating and costing of farm structures, quantity estimate and rate analysis.

II. COURSE OUTLINE

A. Lectures

S.N.	Topic	No. of Lectures
1.	Introduction: definition of surveying, classification, units of measurement, scale (graphical and shrunk scale), and conventional sign	2
2.	Chain survey: methods of linear measurement (Pacing, milage recorder, taping), types of chains and tapes, ranging (Direct and indirect), chaining on sloping ground, chain triangulation, survey stations and survey lines, offset, obstacles in chaining, and plotting	5
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.	Levelling: Definition, objective, principle Levelling instruments Use of dumpy level Temporary adjustment Booking and reducing levels Contour (Introduction, characteristics) Topographic map and its uses	3
5.	Construction material used in the construction of agricultural structure - bricks, cement, sand, gravel, timber, steel, CGI sheet, thatch, concrete, and Mortar	3
6.	Components and construction of farm buildings: Foundation types (Shallow and deep), shallow foundation (brief description), size of foundation, walls, floors, roof, doors and windows, and dampness - its effect and prevention, plastering, painting, skirting, RCC, PCC, scaffoldings, centering and shutters	3
7.	Site selection and planning of farm buildings, thermal insulation and ventilation process and principle in farm buildings	2
8.	Planning, layout and functional requirements of the following structures: (a) Dairy cattle house (b) Poultry house (c) Swine house	6

	(d) Grain storage structure	
	(e) Feed and fodder storage structure	
9.	Estimating and costing: Types of estimate (Approximate and detailed) Procedure of preparing detail estimate of agricultural structures Analysis of rate	3
	Total:	30

B. Practicals

S.N.	Topic	No. of Practicals
1.	Linear measurement and chain survey	2
2.	Measurement of area under plan/map	1
3.	Fieldwork on compass survey	2
4.	Leveling	3
5.	Contour mapping	2
6.	Preparation of drawings of agricultural structures Concept of orthographic projection Dairy cattle house Poultry house	3
7.	Estimate of cost of construction	2
	Total:	15

REFERENCES

Anonymous. 1978. Soil Survey Manual. USDA Handbook No. 18, Oxford & IBH Publishing Co., 1978.

Kanetkan, T.P. and S.V. Kulkarni. 1990. Surveying and Leveling Vol. I and II. Pune Vidyarthi Griha Prakashan, Pune.

UNDERGRADUATE WORKING AND LEARNING EXPERIENCE

Course Code : UPA

Course Title : Undergraduate Practicum Assessment

Credit Hours : 3 (0 + 3) **Full Marks : 75** **Practical : 75**

I. OBJECTIVES

The main objective of the Undergraduate Practicum Assessment is to provide opportunity of exposing the students in production problems, field works, research methodologies and documentation and create the 'Field Extension Laboratory' of the available improved inputs and technologies in the farms of IAAS as well as in the farmers' fields where and when possible.

II. STUDENTS DISTRIBUTION, STUDY DURATION AND EVALUATION

The student has to prepare 30-50 pages written manuscript, which includes title, acknowledgement, contents, abstract, introduction, reviews of literature, materials and methods, results and discussion, summary and conclusions, references and appendices, then defend in the departmental level, improve as per suggestion of major and member advisors, approved by both of them and submit 5 copies of the manuscript and 5 copies of article along with the electronic version to the Assistant Dean (Academics) for final approval.

1. Each department will enroll maximum of 15 students in the first come first entry and practicum assignment basis.
2. Study duration will be of one semester, i.e. six month and the study will be field or lab or both as per recommendation of the advisor.
3. Student will be evaluated by his / her advisor based on the field, lab or both types of work performance (50%), document preparation (20%), department presentation/defense (20%) and question answer/viva (10%).
4. The Practicum topic will be jointly decided by the student and the advisor.
5. Based on the season of agricultural crops and the crop duration to initiate Practicum, the proposal defense will be conducted after completing the course examinations of the sixth semester or during seventh semester.
6. The students should present the proposal in the faculty meeting of the department for approval.
7. The student should conduct Practicum on the approved proposal.
8. After completing Undergraduate Practicum the student should prepare manuscript, The major advisor will go through the research study and suggest correction, if necessary before presentation in the department in presence of interested students and faculties.
9. The student should submit the complete manuscript hardcopy at the end of the eighth semester.