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HISTORY OF THE INSTITUTE

The Institute of Agriculture and Animal Science (IAAS) was born as a School of Agriculture under the Ministry of Agriculture in 1957 to prepare Junior Technical Assistants in Agriculture. In 1968, the school was upgraded to a College of Agriculture and undertook a 2-year Intermediate of Science in Agriculture (I.Sc.Ag.) program. In 1972, the college was reorganized as the IAAS, a constituent institute of Tribhuvan University. In the same year, the Institute moved out of Kathmandu valley to Rampur, Chitwan, 150 km southwest of Kathmandu. The Institute started the Bachelor of Science in Agriculture (B.Sc. Ag.) program in 1977 at the main campus, Rampur. In 1987, the Institute launched a Bachelor of Science in Animal Science (B.Sc.An.Sc.) program, which was later converted to the present Bachelor of Veterinary Science and Animal Husbandry (B.V.Sc.&A.H.) degree in 1993. Two branch campuses at Paklihawa and Sunder Bazar after phasing out I. Sc. Ag. program in 2001, started the courses of initial two years of four year B.Sc. Ag. program. After completion of two year courses at the branch campuses, the students move to the central campus at Rampur for remaining courses of the 3rd and 4th.years of the program. In 1998, the Institute started the Master of Science in Agriculture (M.Sc.Ag.) and Master of Science in Animal Science (M.Sc.An.Sc.) degrees. In the later years M.Sc. Aquaculture (M.Sc.Aqua.) and Master of Veterinary Science (M.V.Sc.) courses were also started. The Ph.D. degree course was started in 2002.

The Institute has 230 ha of land for its academic and research programs at Rampur. Besides, laboratory facilities are available for the postgraduate teaching and research work. The Institute also has 22 and 16 ha of farmlands at the Paklihawa and Lamjung campuses, respectively, which are also available for postgraduate thesis research. There are Agronomy, Horticulture and Livestock farms that cater academic and research needs. The IAAS library has over 27,000 books and subscribes to a number of national and international journals, newspapers and periodicals. Besides, a CABSAC database and an electronic library are available for literature search. A computer center is equipped with 20 microcomputers connected by the local net working (LAN) system.

The Institute follows the integrated concept of teaching, research and extension education. Research and extension education are also coordinated with the classroom teaching. Library, farms and laboratories provide source materials for an effective, systematic and practical education.

Mission and Objectives of the Institute

The mission of IAAS, Nepal's only public institution for higher education in agriculture, is to promote agricultural science and train manpower for agricultural development. The Institute focuses on instruction, research and dissemination of agricultural technologies. The main objectives of the Institute are to:

i) design educational programs in agriculture to address the existing and emerging needs of the people of Nepal,
ii) promote excellence in instruction, research and extension,
iii) produce educated and technically competent graduates for managing and contributing to technical agriculture, extension education, agribusiness, and agricultural and rural development,
iv) undertake research and scholarly activities in agriculture relevant to the needs of the people, and
v) disseminate knowledge through extension services in agriculture.

SECTION-I

MASTER OF SCIENCE (M.Sc.) PROGRAM

MASTER OF SCIENCE (M.Sc.) DEGREE PROGRAM

1. Definition of the Terms or Phrases used in the Bulletin

1.1. **Academic year:** a period of one year beginning in the month of Shrawan (July - August) each year.

1.2. **Semester:** a period covering start of classes till end of the final exams. It covers a period of 90 effective days of teaching plus two weeks for final examinations.

1.3. **Curriculum:** a series of courses designed to provide learning opportunities to meet the requirements for a degree.

1.4. **Course:** a unit of instruction to be covered.

1.5. **Credit hours (or course credit or credits):** each credit hour represents one hour of lecture or 3 hours of field or lab work per week throughout a semester.

1.6. **Course load:** the number of credit hours a student registers in a semester.

2. Degree Name

2.1. Master of Science in Agriculture (M.Sc. Ag.) with Major in (name of the major subject)

2.2. Master of Science in Animal Science (M.Sc.An.Sc.) with Major in (name of the major subject)

2.3. Master of Science in Aquaculture (M.Sc.Aqua.)

2.4. Master of Veterinary Science (M.V.Sc.) with Major in (name of the major subject)

3. Duration of Degrees

The normal duration is two years.

4. System of Education

4.1. Semester system.
4.2. There will be two semesters; the 1st and the 2nd, per academic year.

5. Academic Session

5.1. First Semester

5.1.1. Classes begin – Shrawan (July - August)
5.1.2. Final exams – Mansir (November – December)

5.2. Second Semester

5.2.1. Classes begin – Poush (December – January)
5.2.2. Final exams – Baishakh (April - May)

6. Number of Seats

The number of students to be admitted per year to each major department will be based on available human resource and facilities.

7. Admission Requirements

7.1. Open Competition

7.1.1. For M.Sc. Ag. degree, an applicant must have earned a B. Sc. Ag., or equivalent degree; for M. Sc. An. Sc., an applicant must have a B. Sc. Ag. or B. Sc. An. Sc., or B.V.Sc. & A.H. or equivalent degree; for M. Sc. Aquaculture, an applicant must have a B.Sc. Ag., B.Sc.An.Sc., B.V.Sc. & A.H., B.Sc. Aqua., M. Sc. Zoology or equivalent degree; and for M.V.Sc. degree, an applicant must have a B.V.Sc. & A.H. or equivalent degree.
7.1.2. The candidate must have graduated from an Institution where undergraduate teaching medium is English.
7.1.3. The candidate must have graduated in the 2nd division or above, or an equivalent grade at the undergraduate level.
7.1.4. The candidate must pass the entrance examination conducted by the Institute in the given year.
7.1.5. Final selection will be based on the merit list of the entrance examination.

7.2. In-service Candidate from IAAS

7.2.1. Must meet the requirements stated in the Sections 7.1.1., 7.1.2 and 7.1.3.
7.2.2. Must be officially nominated.

7.3. In-service Candidate from an Agency within Nepal

7.3.1. Must meet the requirements stated in the Sections 7.1.1., 7.1.2 and 7.1.3.
7.3.2. Must be officially nominated.
7.3.3. Must have a letter of financial sponsorship.

7.4. Candidates from Other Countries

7.4.1. Must meet the requirements stated in the Sections 7.1.1., 7.1.2 and 7.1.3.
7.4.2. Must have a proof of financial support.

8. Admission Procedure

8.1. Properly filled out applications forms, required fees, and the certified copies of the academic certificates and transcripts along with three copies of recent passport size

photo of the candidate should be submitted to the Postgraduate Program (PGP), IAAS, Rampur, Nepal, prior to the deadline.

8.2. The deadline for all admission documents, for officially nominated candidates and foreign students, to reach the Postgraduate Program office will be determined by Postgraduate Program Committee.

8.3. The deadlines for application, entrance examination, and admission will be advertised each year. The list of the selected candidates who appear for the entrance test will be posted at the Institute. The selected candidates should submit their original Transfer/College Leaving Certificate, and Character Certificate from the institution last attended. Candidates who completed undergraduate requirements from other universities are required to submit migration certificate for their registration at the Tribhuvan University.

9. Residential Requirement and Time Limit

All the students must meet the residential requirement of at least one and a half years. Maximum time allowed for the completion of the M.Sc. degree from the date of the first enrollment is five academic years. A student must enroll in each semester till his/her degree requirements are completed. If the student is unable to enroll on due date he/she will be fined. However, three months time will be given for final hardbound thesis submission in the subsequent semester beyond which he/she has to register for the semester.

10. Type of Courses

10.1. **Departmental courses:** These are the courses offered primarily by the major department or closely related departments.

10.2. **Basic courses:** These are the courses in Statistics, Plant or Crop Physiology, Biochemistry and Technical Writing.

10.3. **Interdepartmental courses:** These are the same courses taught by more than one department.

10.4. **Seminar:** There will be two seminars, each weighing 1 credit hour. The first seminar normally will be on research proposal while the second seminar will be on research findings.

10.5. **Thesis research:** This refers to development of research proposal, planning and conducting experiments, data collection, data analysis, and interpretation of the findings. A student will receive Satisfactory/Unsatisfactory grade for thesis research.

11. Course Code

The numbers assigned in each course code represent the followings.

- 700 series in general : Postgraduate courses
- 799 : Seminar
- 800 : M.S. Thesis

12. Credit Hour Requirement

12.1. All students admitted to M.Sc. degree programs must enroll and pass a minimum of 36 credit hours. This includes a minimum of 20 credit hours including thesis research and seminars from the major department. In addition, they also must meet the following credit requirements.

12.2. Students admitted to M.Sc. Agriculture with major in plant science disciplines must complete a minimum of 12 credit hours from major departmental courses, 2 credit hours seminar, 6 credit hours Thesis Research, 2 credit hours Technical Writing, 3 credit hours each in Statistics, Biochemistry, and Plant or Crop Physiology. The remaining 5 credit hours can be taken from other relevant department (s).

12.3. Students admitted to M.Sc. Agriculture with major in social science disciplines must complete a minimum of 12 credit hours from major departmental courses, 2 credit hours seminar, 6 credit hours Thesis Research, 2 credit hours Technical Writing, 3 credit hours Statistics. The remaining 11 credit hours can be from other relevant departments.

12.4. All students admitted to M.Sc. Aquaculture must complete a minimum of 12 credit hours from major departmental courses, 2 credit hours seminar, 6 credit hours Thesis Research, 2 credit hours Technical Writing, 3 credit hours each in Statistics and Biochemistry. The remaining 8 credit hours can be from other relevant departments.

12.5. All students admitted to M.Sc. Animal Science must complete a minimum of 12 credit hours from major departmental courses, 2 credit hours seminar, 6 credit hours Thesis Research, 2 credit hours Technical Writing, and 3 credit hours each in Statistics and Biochemistry. The remaining 8 credit hours can be from other relevant departments.

12.6. All students admitted to M.V.Sc. must complete a minimum of 12 credit hours from major departmental courses, 2 credit hours seminar, 6 credit hours Thesis Research, 2 credit hours Technical Writing, and 3 credit hours each in Statistics and Biochemistry. The remaining 8 credit hours can be from other relevant departments.

12.7. All full time students will enroll in 9-16 credit hours per semester except for the last semester of final graduation where credit hours may be lower. A department will not offer more than 12 credit hours in a semester without prior approval of the Dean.

12.8. A **Plan of Study** with a minimum of 36 credit hours of individual students must be approved by the Dean on the recommendation of Major Advisor and Assistant Dean (academic) at the end of first semester.

13. Thesis Research

13.1 The research topic will be decided jointly by the student and the Major Advisor. The research proposal must be approved by the Advisory Committee and forwarded to the Dean through Assistant Dean (Academic) for final approval. The suggestion of the sponsoring/funding agencies for the Thesis Research may be considered, if timely made.

13.2 All students must get the research proposal approved by the end of the 2nd semester. However, thesis research may be initiated in the second semester if a student passes all the courses enrolled in the first semester.

13.3 The student must conduct the research, write a report, and successfully defend it through an open seminar in the presence of the members of his/her advisory committee who will evaluate the performance and recommend for the award of degree if the student has successfully defended the thesis. The committee members may ask the student to modify, change or rewrite the thesis, if necessary. The student will be allowed only two chances to pass the thesis defense. If the student fails twice, he/she will be automatically dropped from the program.

13.4 Eight copies of the well-written hardbound thesis approved by the Advisory Committee must be submitted to the Dean through the Assistant Dean of the Postgraduate Program for final approval. Thesis must be prepared according to the guidelines given in the Information Bulletin of Postgraduate Program.

13.5 Four copies of the full explanatory abstract, both in English and in Nepali, must be submitted, a copy of which will be sent to the related abstract publisher.

14. Advisory System

14.1. An Advisory Committee consisting of a Major Advisor and two other members will academically guide a student throughout the postgraduate study program. The Major Advisor will also serve as the Chairman of the Advisory Committee.

14.2. The Major Advisor will be assigned by the Dean upon recommendation of Assistant Dean of the Postgraduate Program usually prior to the acceptance of a student for admission. In deciding the major advisor of a student, the Assistant Dean may seek advice from the chairperson and other faculty members of the related department and may also consider the interest of the student.

14.3. If the Major Advisor is not assigned prior to the admission, the Assistant Dean of the Postgraduate Program will serve as a temporary Major Advisor till a regular Major Advisor is assigned. The Major Advisor will assist the student in setting up an Advisory Committee.

14.4. The Major Advisor must be from among the faculty members of the major department at Lecturer or above rank

14.5. The other members will consist of one faculty from the major department and one from outside the department or other organizations.

14.6. The Major Advisor will have a Ph.D. degree or an M.Sc. degree with additional qualifications of 5 years of teaching experience after receiving M.Sc degree or with two journal articles or research based book or chapter (other than thesis) published as senior author and has served as a member of the advisory committee of at least one student at postgraduate level.

14.7. Qualified scientists from outside IAAS within T.U., other universities, Nepal Agriculture Research Council, Department of Agriculture and Department of Livestock Services of HMG, or from any related national/international institutions may serve on the Advisory Committee as a Co-advisor or member if approved by the Dean.

14.8. The member of the Advisory Committee from the IAAS must be a teaching faculty of postgraduate program at IAAS. The member from outside the IAAS must be a Ph.D. or a M.Sc. with proven records of research experience in the

field related to the thesis research of the student. For such a member, prior approval must be taken from the Dean by completing the required form. The role of such a member must be specified while preparing the research proposal.

14.9. For being appointed as a Co-advisor, the person must be directly supervising the student in conducting thesis research.

15. Attendance Requirement

A student must be regular in the classes. The minimum attendance for theory and practical separately is 85 percent. In special cases, on the recommendation of the advisor and the Assistant Dean of the Postgraduate Program, the Dean may allow a minimum of 80 percent attendance.

16. Evaluation and Grading

16.1 Internal Assessment

All students must pass internal assessment examination(s) according to the schedule given by the course teacher in order to qualify for appearance in the final examination. A student missing out on the internal assessment examination may be allowed to take a makeup test if prior arrangements are made with the course teacher. If prior arrangements are not made with the course teacher, the Assistant Dean of the Postgraduate Program may permit a makeup examination under valid reasons. The makeup examination must be completed within 15 days from the scheduled date of missed out examination. There will be no makeup if the final examination is missed out. In this case, the student will have to pass the course (s) under Back Paper Examination in the following semesters.

16.2 Examination System

Final Examination (Theory and Practical)	:	External
Internal Assessment		Internal
Comprehensive	:	External

16.3 Evaluation of Theory

Internal Assessment		
Written test	:	25%
Assignment(s)/Term paper	:	25%
Final examination	:	50%

16.4 Evaluation of Practical

Final examination	:	100%

16.5 Passing a Course

16.5.1. A student must pass the final examinations both in the Theory and in Practical. A student failing in the final examination of either theory or practical or both will be required to re-enroll and pass the course.

16.5.2. Score for passing a course is 50% in all the examinations (internal assessment, theory and practical).

16.6. Points for Final Grading of a Course

Final scoring of each credit will be done in 50 points.

16.7. Scholastic Requirements

16.7.1. A student failing a course must re-enroll and pass it. However, the student passing the internal assessment in a given subject needs not to reappear for internal assessment. The new score will replace the score received in the previous enrollment of the course with an 'R' beside it.

16.7.2. A student failing the same course thrice will be automatically dropped out from the postgraduate program.

16.8. Letter Grades

P : In progress (for ongoing research)
S : Satisfactory (for research and other courses to be graded Satisfactory or Unsatisfactory)
US : Unsatisfactory (for research and other courses to be graded Satisfactory or Unsatisfactory)
F : Failed
R : A repeated course

16.9. Passing Division of the Postgraduate Degree

85% and above	:	Passed with Distinction (Excellent performance)
75 to 84.9%	:	Passed in the 1st division (Very Good performance)
65 to 74.9%	:	Passed in the 2nd division (Good performance)
50 to 64.9%	:	Passed in the 3rd division (Fair performance)
Less than 50%	:	Failed (Poor performance)

17. Comprehensive Examination

17.1. After successful completion of about 80 percent of the course credits approved in the **Plan of Study**, a student must pass a written comprehensive examination conducted by the examination division of the Institute. For successful completion of this examination, the student must secure 50% marks. In case of failure, a second chance will be given to the student after at least one month from the first examination. The student, failing even in the second examination will be automatically dropped from the program.

17.2. A student can submit thesis to the PG program for examination only after passing the comprehensive examination.

18. Seminar

18.1 A student must enroll and present two graduate seminars of one credit each. The first seminar will be usually on the thesis proposal and second on the findings of thesis research. However, only one credit will be registered in a semester.

18.2 The student seminar will be evaluated jointly by the seminar teacher and the external examiner. The passing score is 50 percent.

19. Completion of a Degree Program

19.1. For completion of a degree program, a student must have:

i) passed all the courses with a minimum of 50 percent in each course, and

ii) successfully conducted the postgraduate thesis research, written an acceptable thesis, and passed all the required examinations.

19.2. A student enrolled in a semester who intends to graduate must submit finally hard bound copies of the thesis, signed by all members of his/her advisory committee, to the postgraduate program. The deadline for draft thesis submission for defense is the last working day or a day before admission date for the following semester. The students will be given three months time for final hardbound thesis submission in the following semester. The student failing to do so must enroll in the following semester (s).

20. Dropping a Semester

Once admitted, a student shall not be allowed to drop the semester or course(s). If a student does not appear in the final examination, he/she will be considered as failed in the subject(s) registered in a given semester. A student cannot differ the admission. For valid reasons, if a student must misses out a complete semester of instruction with enrollment, the Postgraduate Program Committee may allow re-admission, if prior approval is obtained by the student. Once admitted, no fees, whatsoever, will be refunded if a student decides to quit the academic program.

21. The Postgraduate Program Committee

The Dean will constitute the postgraduate committee. This committee will assist Dean and the PG program on execution and implementation of the M.Sc. degree program. The composition of the committee will be as follows.

Dean	Chairman
Assistant Dean (Academic)	Member-Secretary
Assistant Deans	Members
Campus Chief, Rampur Campus	Member
Director of Research	Member
Director of Extension	Member
Heads of the PG teaching departments	Members

SECTION-II

DOCTOR OF PHILOSOPHY (Ph.D.) PROGRAM

PLAN-A

DOCTORAL (Ph.D.) PROGRAM : PLAN-A

1. Definition of the Terms and Phrases used in the Bulletin

1.1. **Academic year:** a period of one year beginning in the month of Shrawan (July-August) each year.

1.2. **Semester:** a period covering start of classes till end of the final exams. It covers a period of 90 effective days of teaching plus two weeks for final examinations.

1.3. **Curriculum:** a series of courses designed to provide learning opportunities to meet the requirements for a degree.

1.4. **Course:** a unit of instruction to be covered.

1.5. **Credit hours (or course credit or credits):** each credit hour represents one hour of lecture or 3 hours of field or lab work per week throughout a semester.

1.6. **Course load:** the number of credit hours a student registers in a semester.

1.7. **Postgraduate:** usually includes both M.Sc. and Ph.D. unless stated otherwise.

2. Degree Name

2.1. Doctor of Philosophy (Ph.D.) in Agriculture with major in (name of the major subject) and minor in (name of the minor subject).

2.2. Doctor of Philosophy (Ph.D.) in Animal Science with major in (name of the major subject) and minor in (name of the minor subject).

3. Duration of Ph.D. Degree

The normal duration is three years.

4. System of Education

4.1. Semester system.

4.2. There will be two semesters, the 1st and the 2nd, per academic year.

5. Number of Seats

Based on available human resource and facilities.

6. Admission Requirements

6.1. Open Competition

6.1.1. For Ph.D. degree an applicant must have earned a M.Sc. Ag. or equivalent degree in the related field

6.1.2. The candidate must have graduated from an Institution where undergraduate and postgraduate teaching medium is English.

6.1.3. The candidate must have graduated in the 1st division or equivalent at the master level.
6.1.4. The candidate must have published at least two research articles in the journal as a senior author.
6.1.5. Must produce confidential letters of recommendation from two referees who would be in a position to judge academic and research capabilities of the candidate to undertake the Ph.D. study successfully. At least one of the letters must be from a university professor.
6.1.6. Must produce and present orally a concept research proposal for Ph.D. dissertation before the Ph.D. Committee.

6.2. In-service Candidates from IAAS

6.2.1. Must meet the requirements stated in the Sections 6.1.1, 6.1.2, 6.1.4, 6.1.5 and 6.1.6.
6.2.2. Must have graduated with a minimum of the second division or equivalent at the master level.
6.2.3. Must be officially nominated

6.3. Sponsored/In-service Candidates from an Agency within Nepal

6.3.1. Must meet the requirements stated in the Sections 6.1.1, 6.1.2, 6.1.4, 6.1.5, 6.1.6 and 6.2.2.
6.3.2. Must have a letter of financial sponsorship

6.4. Candidates from Other Countries

6.4.1. Must meet the requirements stated in the Sections 6.1.1, 6.1.2, 6.1.4, 6.1.5, 6.1.6 and 6.2.2.
6.4.2. Must have a proof of financial support.

7. Admission Procedure

7.1. Properly filled out applications forms, required fees and the certified copies of the academic certificates and transcripts along with three copies of recent passport size photo of the candidate should be sent to the Postgraduate Program, IAAS, Rampur, Nepal, prior to the deadline.
7.2. The candidate must defend the concept research proposal in presence of the Ph.D. Committee.
7.3. For open competition, the deadlines for application and admission will be advertised each year. The list of the selected candidates will be posted at the Institute. The selected candidates should submit their original transcripts, certificates and other documents at the time of admission. The candidates who have not been previously registered in the Tribhuvan University are required to submit their migration certificates for their registration at the Tribhuvan University.

8. Qualifying Examination

All students willing to enroll in the Ph.D. program must take a written qualifying examination. It consists of two parts; Part A: English test, Part B: Subject test. The Ph.D. Committee will conduct this examination. To pass the qualifying examination, a student must obtain 50% marks in each part. A student failing the qualifying examination will not be admitted in the Ph.D. program. However, if a student produces TOEFL score of 500 or above need not to take English test for Ph.D. admission but the part B of qualifying examination (i.e. Subject matter test) must be taken by the end of the 1st semester of the enrolment.

9. Residential Requirement and Time Limit

All the students must meet the residential requirement of at least two-years. Maximum time allowed for the completion of the Ph.D. degree from the date of the first enrollment is seven academic years. The postgraduate students must sign up the daily student attendance register in the related department. A student must enroll in each semester till his/her degree requirements are completed or till the acceptance of final hardbound dissertation. If a student fails to do so, he/she will automatically be dropped from the academic program.

10. Type of Courses

10.1. **Departmental courses**: These are the courses offered primarily by the major department or closely related departments.
10.2. **Basic courses:** These are the courses in Statistics, Plant/Crop Physiology, Biochemistry and Technical Writing.
10.3. **Interdepartmental courses:** These are the same courses taught by more than one department.
10.4. **Seminar:** There will be two seminars, each weighing 1 credit hour. The first seminar will be on dissertation research proposal while the second seminar will be on research findings.
10.5. **Dissertation research:** This refers to development of research proposal, planning and conducting experiments, data analysis, and interpretation of the findings. A student will receive Satisfactory/Unsatisfactory grade for thesis research.

11. Course Code

The numbers assigned in each course code represent the followings.

- 700 series in general : Postgraduate courses
- 899 : Ph.D. seminar
- 900 : Ph.D. dissertation

12. Credit Hour Requirement

12.1. All students admitted to Ph.D. program must enroll and pass a minimum of 45 credit hours including 15 credit hours of dissertation and 2 credit hours of Ph.D. seminar.
12.2. All students must complete a minimum of 12 credit hours postgraduate courses, 2 credit hour seminars and 15 credit hours dissertation from major department,

and a minimum of 8 credit hours from the department of minor subjects. The remaining 8 credit hours can be taken from any relevant department.

12.3. All students majoring in Crop Science (Agronomy, Horticulture, Plant Breeding, Soil Science, Plant Pathology, Entomology and Environmental Science) are also required to complete Agricultural Statistics, Crop or Plant Physiology and Biochemistry courses. The students admitted to Animal Science program, are required to complete Agricultural Statistics and Biochemistry. The students majoring in Social Sciences are required to complete Statistics or Research Methods in Social Sciences. These requirements can be exempted if a student has completed such courses at the M.S. level. However, exemption doesn't mean the reduction in the total 45 required credit hours.

12.4. All students must enroll in 9-16 credit hours per semester except for the last semester of final graduation where credit hours may be lower.

13. Dissertation

13.1. The research proposal for the dissertation submitted by the student will be reviewed by the members of the Advisory Committee and forward to IAAS Research Committee through PG Coordinator. The Dean upon the recommendation of the Research Committee will approve the proposal. The suggestion of the sponsoring/funding agencies may be considered, if timely made.

13.2. All students must get the research proposal approved by the end of the 2nd semester. However, dissertation research may be initiated in the second semester if a student passes all the courses enrolled in the first semester.

13.3. The student must conduct the research, write a report, and submit for external evaluation. After the acceptance from the external examiner, the student is required to defend it successfully through an open seminar in the presence of the members of his/her advisory committee who will evaluate the performance and recommend for the award of the degree if the student has successfully defended the dissertation. The Advisory Committee members may ask the student to modify, change or rewrite the report, if necessary. The student will be allowed only two chances to defend the dissertation. If the student fails twice, he/she will be automatically dropped from the program.

13.4. The Dean will send the student's dissertation for the external evaluation either in country or outside the country. The external examiner must approve the dissertation for degree award. The student may be asked to incorporate the comments of external examiner(s) before accepting for degree award. In case of disapproval of a dissertation, a second opinion would be sought from a second examiner. If the second examiner also rejects the dissertation, the student will be automatically dropped from the Ph.D. program.

13.5. Eight copies of a well-written dissertation approved by the Advisory Committee must be submitted to the Dean for final approval. Dissertation must be prepared according to the guidelines for thesis/dissertation preparation provided in the Annex I and Appendices A- J) of the **Information Bulletin: Postgraduate Program**

13.6. Six copies of the full explanatory abstract, both in English and in Nepali, must be submitted.

14. Advisory System

14.1. An Advisory Committee consisting of a Major Advisor and a minimum of two other members will academically guide a student throughout the Ph.D. study program. One of the two members will come from the major department and another from the minor department. The Major Advisor will serve as the Chairman of the Advisory Committee.

14.2. The Major Advisor will be assigned by the Dean usually prior to the acceptance of a student for admission.

14.3. If the Major Advisor is not assigned prior to the admission, the Assistant Dean of the Postgraduate Program will serve as a temporary Major Advisor till a regular Major Advisor is assigned. The Major Advisor will assist the student in setting up an Advisory Committee.

14.4. The Major Advisor must be a Ph.D. from among the faculty members of the related department at the rank of Reader or Professor, have served as the Chairman of the advisory committee at M.Sc. level, and have published 5 articles with a minimum of 3 as the senior author.

14.5. Senior Ph.D. scientist from outside IAAS within T.U., other universities, NARC, Department of Agriculture, or from any related national/international institutions may serve on the Advisory Committee as Co-advisor or as a member if agreed upon by the Major Advisor and the approved by the Dean. For such a member, prior approval must be taken from the Dean by completing the required form. The role of such a member must be specified in preparation of the student's dissertation.

14.6. The members of the Advisory Committee from IAAS must be a Ph.D. and have 3 research articles published in the journal as a senior author. The non-teaching member from outside IAAS must be a Ph.D. with proven records of research experience and published at least 3 research articles in the journal as a senior author.

14.7. For being appointed as a Co-advisor, the person must be directly supervising the student in conducting thesis research.

15. Attendance Requirement

Same as Section 15 of M.Sc. Program

16. Evaluation and Grading

Same as Section 16 of M.Sc. Program

17. Comprehensive Examination

17.1. After successful completion of at least 80% of the courses approved on the Plan of Study, there will be a written comprehensive examination conducted by the examination section followed by a verbal examination conducted by the students Advisory Committee. The student will be graded on the basis of both written and verbal examinations. The written and verbal examinations will carry 75% and 25% points, respectively. For successful completion of this examination, the student must secure cumulative 50% marks. In case of failure, a second chance

will be given to the student only after at least one month from the first examination. The student, failing even in the second examination will be automatically dropped from the program.

17.2. A student will be declared a candidate for Ph.D. degree only after his/her successful completion of the Comprehensive Examination.

17.3. A student can submit dissertation to the Postgraduate Program for examination only after passing the comprehensive examination.

18. Seminar

18.1 A student must enroll and present two graduate seminars of one credit each. The first seminar will be usually on the dissertation proposal and second on the findings of the research. However, only one credit will be registered in a semester.

18.2 The student seminar will be evaluated jointly by the seminar teacher and the external examiner. The passing score is 50% in aggregate.

19. Completion of the Degree Program

19.1. For completion of the Ph.D. degree program, a student must have:

i) Passed all the courses with a minimum of 50% in each course, and

ii) Successfully conducted the doctoral dissertation research, written an acceptable dissertation, incorporated the comments of external examiner and passed all the required examinations.

19.2. A student enrolled in a semester who intends to graduate must submit the final hardbound dissertation signed by all members of his/her advisory committee, to the postgraduate program by the last working day before admission date for the following semester. The student failing to do so must enroll in the following semester.

20. Dropping a Semester

Once admitted, a student shall not be allowed to drop the semester or course(s). If a student does not appear in the final examination, he/she will be considered as failed in the subject(s) registered in a given semester. A student cannot differ the admission. For valid reasons, if a student must misses out a complete semester of instruction with enrollment, the Postgraduate Program Committee may allow re-admission, if prior approval is obtained by the student. Once admitted, no fees, whatsoever, will be refunded if a student decides to quit the academic program

21. The Ph.D. Program Committee

The Dean will constitute the Doctoral Program Committee to assist the PG Program for the execution and implementation of the Ph.D. program. The composition of the committee will be as follows.

Dean	Chairman
Assistant Dean (Academic)	Member-secretary
Director of Research	Member
Three subject related senior faculty	Invitees

SECTION-III

DOCTOR OF PHILOSOPHY (Ph.D.) PROGRAM

PLAN-B

DOCTORAL (Ph.D.) PROGRAM : PLAN-B

1. Definition of the Terms and Phrases used in the Bulletin

17.1. **Academic year:** one year period beginning July-August (1st -Semester) each year.

17.2. **Semester:** period covering start of classes till end of the final examinations. It covers a period of 90 effective working days plus two weeks for final examinations.

17.3. **Curriculum:** series of courses designed to provide learning opportunities to meet the requirements for a degree.

17.4. **Course:** unit of instruction to be covered.

17.5. **Credit hours (or course credit):** each credit hour represents one hour of lecture or 3 hours of field or lab work per week throughout a semester.

17.6. **Course load:** number of credit hours registered by a student in a semester.

18. Degree Name

18.1. Doctor of Philosophy (Ph.D.) in Agriculture majoring in ……(Name of the subject).

2.2. Doctor of Philosophy (Ph.D.) in Animal Science majoring in …(Name of the subject).

2.3. Doctor of Philosophy (Ph.D.) in Aquaculture majoring in ……(Name of the subject).

19. Duration of Ph.D. Degree

The normal duration is four years; however, it may be a minimum of three years, and a maximum of seven years from the date of first enrollment in the program. The student failing to complete the requirements within seven years will be automatically dropped out from the program.

20. System of Education

20.1. Semester system will be followed. There will be two semesters in an academic year.

21. Number of Seats

21.1. Based on the choice of the students and available human resource and facilities, students will be enrolled in the departments in each academic year.

22. Admission Requirements and Procedures

22.1. The candidate seeking for Ph.D. admission must have obtained M.Sc. or equivalent degree in the related field with first division marks from the institutes where the medium of instruction is English, produced thesis and a minimum of two journal articles published being the first author or produced five reports being a researcher. However, if an applicant has second division marks in the M.Sc degree with proven

ability of doing research continuously for several years and published at least five papers being the first author in the referred national or international journals or produced ten reports being a researcher may also apply for admission in Ph.D. program.

22.2. Application forms and information on admission can be obtained by writing to the Postgraduate Program Office, IAAS, Rampur, Chitwan, Nepal by paying the fee for application form and Postgraduate Bulletin. The application form can also be downloaded from **iaas.edu.np** website, for which fee can be paid before PG Registration by the students.

22.3. The candidate must produce properly filled out applications forms and the certified copies of the academic certificates and transcripts, two recommendation letters from the professors, and curriculum vitae along with three copies of recent passport size photos to the Postgraduate Program Office prior to the deadline.

22.4. The candidate must submit concept proposal for Ph.D. dissertation, defend his/her proposal and face an interview at least a week before the date of PG Registration.

22.5. The candidate must produce sponsorship or financial guarantee for the study program.

22.6. The selected candidate must submit a medical fitness certificate from the physician of government hospital. The candidate declared medically unfit will not be admitted for study.

22.7. The selected candidate will get provisional admission in the first semester. The Ph.D. Admission Committee will have every right for the selection or rejection of the candidate.

23. Advisory System

23.1. There will be four members including the Major Advisor in the Advisory Committee of the student based on the area of research.

23.2. The Dean of IAAS will appoint the Major Advisor of the student on the basis of research area and the student's priority of selection usually prior to admission of the student, or not later than a month of provisional admission.

23.3. Member of Advisory Committee will be decided on the basis of proposed area of research upon the recommendation of Major Advisor / Assistant Dean (Academics) within a month of Major Advisor appointment.

23.4. The Major Advisor must be a Ph.D. degree holder working at the capacity of Professor or Associate Professor, or M.Sc. degree holder working at the capacity of Professor among the faculty members from the related department, and must have at least five research papers published in the referred journals being the first author and must have supervised at least three Postgraduate students (MS students) being a Major Advisor.

23.5. The members of the Advisory Committee from IAAS must be a Ph.D. degree holder and have at least two research publications in the journal being the first author and supervised at least three Postgraduate students, or M.Sc. degree holder having at least three research publications in the referred journal being the first author and supervised at least five students in MS.

23.6. Senior scientists or professors with MS or PhD degrees having at least three research articles published in journals or five research reports published from within or outside the country could also be the members of the Advisory Committee.

24. Qualifying Examination

The provisionally admitted student in the Ph.D. Program must take a written qualifying examination during or before the end of the first semester after formation of his/her Advisory Committee and finalization of the Ph.D. thesis research program by the committee. The content of the qualifying examination will be based on the knowledge of the working discipline and the area of Dissertation Program. All the members of the Advisory Committee will give examination to the candidate and if he/she is unable to get 60% marks, he/she has to register some of the Postgraduate Course(s) as recommended by the Advisory Committee to acquire knowledge and skills in the related discipline.

25. Requirement of Courses

25.1. Normally no courses will be required to get registered, however, if the Advisory Committee feels that he/she needs to take some of the specified or other courses such as certain techniques, research methodology, biochemical analysis, design of experiments so on to support to the research work to be carried out, he/she should take them as non-credit courses and must pass in the final examination conducted by the Examination Division, Office of the Dean.

25.2. If courses are required, the student must register three (minimum) to nine credit hours (maximum) in a semester as specified by the Advisory Committee.

26. Course Code

The numbers assigned in each course code represent the followings:

- 700 series in general : Postgraduate courses
- 899 : Ph.D. seminar
- 900 : Ph.D. dissertation

27. Dissertation Research

27.1. The Ph.D. dissertation will be a total of thirty credit hours. However, he/she can register six credit hours each semester to accomplish his research activities, progress report preparation and presentation in the concerned department including a dissertation seminar in each semester.

27.2. The student will develop the research proposal and upon the recommendation of the Advisory Committee, he/she will forward to the Postgraduate Office for approval. The Assistant Dean (Academic) will forward to the Dean through Research Committee for final approval.

27.3. The research conducted by the student will be frequently monitored and reviewed by his/her Advisory Committee.

27.4. The student will submit three copies of loosely bound dissertation (150-250 typed pages) for internal and external evaluation.

28. Seminar/Progress Report

28.1. The scholar will present proposal seminar in the first semester and progress of the research activities in the following semesters. The members of the Advisory

Committee will evaluate them independently. If majority of advisory committee evaluate unsatisfactory, the candidate will get another chance to improve and present his/her progress, and again the student failing to complete the requirements will be automatically dropped out from the program.

29. Comprehensive Examination

29.1. After successful completion of at least 80% of the research works approved on the Plan of Research, there will be a written comprehensive examination conducted by the examination section followed by oral examination conducted by the students Advisory Committee. The student will be graded on the basis of both written and oral examinations. The written and verbal examinations will carry 75% and 25% points, respectively. For successful completion of these examinations, the student must secure cumulative 60% marks. In case of failure, a second chance will be given to the student only after one month from the first examination. The student, failing even in the second examination will be automatically dropped from the program.

29.2. A student will be qualified to Ph.D. degree study only after his/her successful completion of the Comprehensive Examination.

29.3. A student can submit dissertation to the Postgraduate Program for examination only after passing the comprehensive examination.

30. Completion of Degree Program

30.1. The student must conduct the research, write a dissertation draft, and present progress report through his/her presentation in the department and dissertation seminar in each semester and finally submit his/her dissertation for external evaluation. One copy will be examined internally within the institute, other two copies externally, i.e. nationally and internationally. After the acceptance from at least two examiners, the student is required to defend his dissertation successfully through an open seminar in the presence of the members of his/her advisory committee. The members of the advisory committee will evaluate the performance and recommend for the award of the degree if the student has successfully defended the dissertation and completed all the requirements.

30.2. Majority of the Advisory Committee must agree research progress, departmental presentation, dissertation seminar and final draft submission for satisfactory result. The Advisory Committee members may ask the student to modify, change or rewrite the report, if necessary. The student must publish at least one research article in international journal and two articles in national journals from his dissertation research or accepted for publication before defending his/her dissertation. The student will be allowed only two chances to defend the dissertation. If the student fails again, he/she will be automatically dropped from the program.

30.3. The Dean will send the student's dissertation for the external evaluation either within the country or outside the country. The external examiner must approve the dissertation for degree award. The student may be asked to incorporate the comments of external examiner(s) before accepting for degree award. In case of disapproval of a dissertation, a second opinion would be sought from a second

examiner. If the second examiner also rejects the dissertation, the student will be automatically dropped from the Ph.D. program.

30.4. After incorporating all the comments and suggestions, eight copies of a well-written dissertation approved by the Advisory Committee must be submitted to the Dean for final approval. Dissertation must be prepared according to the guidelines for thesis/dissertation preparation provided in the Annex I and Appendices A- J) of the **Information Bulletin: Postgraduate Program**.

30.5. In addition, a copy of published articles and articles prepared for publication, eight copies of the full explanatory abstract, both in English and in Nepali, including electronic version of final dissertation draft must be submitted.

31. Attendance Requirement

31.1. If the student has not taken any courses, and he/she is fully involved in research in or outside the institute, he/she has to regularly report his/her advisor. His/her advisor and committee members are solely responsible and regular attendance may not be necessary. However, the student has to be regular in the campus in the first semester for qualifying examination, full proposal preparation, proposal presentation seminar and if any courses specified to audit by the advisory committee. Similarly, the student must be regular in the final semester in the campus for all data management, analysis, draft preparation and presentation in the seminar before finalizing the draft to submit for internal and external evaluation. The residence requirement for the student is one year before defending his dissertation of PhD degree.

32. Evaluation and Grading

If the students are advised by the Advisory Committee to enroll and audit/visit some departmental and inter-departmental courses, they must be regular in the class, complete all assignments, pass in the examination and get satisfactory course completion form filled up and submitted to the Examination Section.

17. Dropping a Semester

Once admitted, a student shall not be allowed to drop the semester or course(s). If a student does not appear in the final examination, or present his/her progress report, he/she will be considered as failed in the subject(s) or research registered in a given semester. For valid reasons, if a student must miss out a complete semester of instruction with enrollment, the Postgraduate Program Committee may allow re-admission, if prior approval is obtained by the student. Once admitted, no fees, whatsoever, will be refunded if a student decides to quit the academic program.

18. The Ph.D. Program Committee

The Dean will constitute the Doctoral Program Committee to assist the PG Program for the execution and implementation of the Ph.D. program. The composition of the committee will be as follows:

Dean	Chairman
Assistant Dean (Academics)	Member-secretary
Research Director	Member

Professor from relevant department Member

1. AGRICULTURAL ECONOMICS

Departmental Courses		Credit Hrs
AEC 701	Mathematical Economics	3+0
AEC 702	Microeconomics	3+0
AEC 703	Macroeconomics	3+0
AEC 704	Econometrics	3+0
AEC 705	Research Methods for Social Sciences	3+0
AEC 706	Economic Growth and Development	2+0
AEC 708	Public Economics	3+0
AEC 709	Agricultural Price Analysis and Policy	3+0
AEC 710	Advanced Forest Management and Economics	3+0
AEC 711	Socioeconomic and Technical Aspects of Irrigation Management	3+0
AEC 712	Project Appraisal and Evaluation	3+0
AEC 713	Financial Management in Agriculture	3+0
AEC 714	Natural Resource Economics	3+0
AEC 715	Economics of Agricultural Marketing	3+0
AEC 716	International Agricultural Trade	3+0
AEC 717	Organization and Management of Agricultural Research and Development	3+0
AEC 718	Agricultural Production Economics	3+0
AEC 719	Agribusiness and Management	3+0
AEC 720	Farm Management Economics	2+1
AEC 721	Statistics for Social Sciences	2+1
AEC 799	M.Sc. Seminar	0+2
AEC 800	M.Sc. Thesis	0+6
AEC 899	Ph.D. Seminar	0+2
AEC 900	Ph.D. Dissertation	0+15

AEC 701 Mathematical Economics (3+0)

Nature and scope of mathematical economics; economic models: linear and non-linear; equilibrium analysis in economics; matrix algebra and its economic applications; comparative static analysis, the concept of derivative; roles of differentiation and their use in comparative static analysis of general function models; optimization problems a special variety of equilibrium analysis; integral calculus and its applications; mathematical programming; linear programming; non-linear programming.

AEC 702 Microeconomics (3+0)

Definition, scope and nature of microeconomics; economic models and paradigm; theory of consumers' behavior: basic concepts, nature, utility function, and its existence, consumers' equilibrium models; demand functions: concepts, nature, types and derivation; income and substitution effect of a price change; various elasticities and their relations; theory of firms: production, cost, and supply functions with their relations and derivations; various product concepts of a resource and resource substitutability; constrained output

maximization and cost minimization; duality of cost and production functions; homogeneous production function and returns to scale; market structures and their equilibrium models; price discrimination; factor and product markets and their equilibrium; government interventions, dynamic equilibrium and lagged adjustment; welfare economics: external economies and diseconomies, public goods, case theorem and the theory of second best; measurement of welfare.

AEC 703 Macroeconomics (3+0)

Concept and measurement of national income; social accounting; money, income and interest; fiscal and monetary policies; significance of changes and distribution of income; demand for and supply of money; macroeconomic variables and factors affecting them; aggregate demand and supply; consumption, saving and investment; multiplier effects of investments; general prices, wages and employment; inflation and deflation; budget deficits, public debts and unemployment; exports, imports and balance of payment; growth and productivity; trade cycle theory; interdependence and international adjustments.

AEC 704 Econometrics (3+0)

Econometrics and econometric modeling; review of classical regression model; regression on dummy variables; general linear statistical models; (OLS, MLE); dynamic models; generalized linear statistical models; autocorrelation; heteroscedasticity; data problems (multicollinearity); simultaneous equation models; discrete choice models; limited dependent variable model; non-linear models.

AEC 705 (or EXT 705) Research Methods for Social Sciences (3+0)

Nature and types of social research; research process and research designs; sampling and sampling designs; hypothesis and hypothesis testing; parameters and variables; variables and their levels of measurement; scales and scaling techniques; planning social research; methods and techniques of data collection; development of questionnaire and interview schedules; interview and interviewing techniques; coding and management of data; techniques of data analysis and report writing.

AEC 706 Economic Growth and Development (2+0)

Definitions of and distinction between growth and development; characteristics of under development; stages of growth and development, factors for growth promotion and retardation; development forces and strategic development; lessons from the past; obstacles of development with special reference to developing countries; explorations of development possibilities; study of economic systems: socialism, capitalism and the mix; study of various growth theories; Marxist, Classical, Balanced, Unbalanced, Big push, and Schumpeter's and the consequences of foreign aids and investments; agricultural growth and technical change; induced innovation theory; measuring technical change.

AEC 708 Public Economics (3+0)

Components of the institutional economy; property as a power; concepts of property right; incompatible use and exclusion costs; economy of scale; joint and impact goods; transaction costs; surplus; demand and supply function; methods of institutional analysis; normative rules for choice among alternative institutions; measurement of performance of alternative institutions; experimental and quasi experimental design; rationality theory; alternative modes of ownership; cooperatives; user group; labor institutions; prisoners dilemma; political institutes and participation.

AEC 709 Agricultural Price Analysis and Policy (3+0)

Quantitative measurement of factors affecting agricultural prices; seasonal and cyclical fluctuations; index numbers and quantitative variables relative to prices; analysis of demand and supply relationships in agriculture; price determination under various market situations; spatial equilibrium; temporal price pattern; pricing institutions; analysis of agricultural policies; border price; exchange rates; adjusting the prices of export and import; coefficient of protection; coefficient of comparative advantage; domestic resource cost; critical review of the agricultural pricing policies of both inputs and outputs and the existing marketing information systems of Nepal.

AEC 710 Advanced Forest Management and Economics (3+0)

The demand and characteristics of forest products; the theory of the derived demand; the demand for manufactured forest products; the demand for stumpage; estimating the demand for forest products; forecasting techniques; solid wood demand model; pulp and paper demand models; the supply of forest products; characteristics of the supply of manufactured products; the production function; supply theory; forest product supply; stumpage supply; the determination of forest product prices, structure of forest product industries; solid wood and paper pulp prices; price determination in spatially separated markets; inter regional and international trade; pricing practices of the forest products; multiproduct firms; price leadership; price discrimination; joint product pricing; supply and demand situation of timber; trends for demand and supply of forest products in Nepal and Asian countries; importance of international trade and its implications.

AEC 711 Socioeconomic and Technical Aspects of Irrigation Management (3+0)

Irrigation as a socio-technical enterprise; inter/cross/multidisciplinary nature of irrigation; technology, resources and organization as a framework for addressing irrigation problems; knowledge needs and policy issues for irrigation from economic perspectives; financial requirements and resource mobilization for irrigation; recurrent cost for financing as a major concern to government and donor agencies; distinction between irrigation financing and cost recovery; human aspects of irrigation; users group; government bureaucracy; informal organizations and their relations to technical, physical and economic considerations; donors policies; world bank, USAID and Asian Development Bank; examination of policy statements of irrigation cost recovery and their rational; irrigation financing policies and efficiency and equity considerations; repair and maintenance of irrigation structures; source of finance; users fees, government subsidies and income from

financially autonomous irrigation agencies; ability and willingness of users to pay irrigation fees; improving performance of both the farmers' and agency managed irrigation systems; augmentation and effective organization of available resources and irrigation facilities.

AEC 712 Project Appraisal and Evaluation (3+0)

Concept of project and programs; types of projects and planning cycles; project goals and objectives; selection of projects; feasibility study and preparation; technical, political, institutional, organizational, environmental, financial and human aspects of project planning; Investment, economic and social analysis, sensitivity analysis and network analysis; risk and uncertainty.

AEC 713 Financial Management in Agriculture (3+0)

Concepts; financial markets and meaning of its management; process of management; financial intermediation; financial market and financial intermediaries; concepts and tools of financial management; managerial goals; information flows; financial analysis; firm growth; leverage and financial risk; time value of money; capital budgeting; cost of capital; alternatives in resource control; controlling the use of land; controlling the use of depreciable assets; controlling and operating inputs and evaluating financial feasibility; topics in financial management; alternatives in business organization; business organization and outside equity capital in agriculture.

AEC 714 Natural Resource Economics (3+0)

Concept of resources; renewable and non-renewable resources; resources and environmental issues, economic theories and inter-temporal efficiency of resource use; property right; criteria for formulating appropriate economic policies; income and its efficient distribution; externalities; valuation techniques for non-marketable goods and services; sources of inefficiency; institutional framework of valuation; state and the natural resources; allocation of exhaustive and biological resources, land and its use policy; pollution and its control;: water, forests and minerals; development and conservation of scarce resources; decision making and efficient use of natural resources; the social impact assessment process.

AEC 715 Economics of Agricultural Marketing (3+0)

Marketing and market structures; agricultural marketing systems; transportation issues and location theory; consumers' choice and demand; temporal and spatial dimension of price and product distribution; complete demand models; analysis of technical and pricing efficiency of agricultural markets; examination of issues relating to agricultural markets and marketing; critical evaluation of theoretical and empirical procedures for estimating supply and demand relations; production functions; mathematical programming; growth models of firms and simulation; development of agricultural market; critical review of the roles of various agencies involved in the marketing of agricultural products and formulating of policies in Nepal.

AEC 716 International Agricultural Trade (3+0)

Introduction to international economics; gains from international trade; theories of international trade: absolute and comparative cost advantage; opportunity cost verses comparative advantage principle; Heckscher-Ohlin theory of international trade; product cycle hypothesis; Leontif paradox, nature of trade for agricultural products; agricultural trade policy issues raised by UNCTAD, GATT, WTO, SAPTA; partial equilibrium analysis of international trade for agricultural products; institutional aspects of international marketing of agricultural products; balance of payments; general equilibrium approaches to the adjustment of balance of payments; adjustment under IMF system; theories of exchange rate determination; exchange control: objectives and methods, commercial policies, tariff and its effects; optimum tariff and subsidy quotas; dumping; state trading; review the role of international financial institutions (ADB, World Bank, IMF, IFAD) in economic development of least developed countries; review of current foreign trade and commercial policy of Nepal with special reference to agricultural commodities.

AEC 717 Organization and Management of Agricultural Research and Development (3+0)

Overview of agricultural research and development; role of agricultural research in technology development; agricultural research institutions: their problems and prospects; factors associated with effective management of researches: personal and institutional; evaluation of research and development programs; cooperation with/of donor agencies; regionalization/decentralization of research programs; development of research infrastructures and linkages with concerned persons and institutions; role and responsibility identification and implementation; investment and financial management; monitoring and evaluation of research/ development programs.

AEC 718 Agricultural Production Economics (3+0)

Meaning and scope of production economics; functional relationships of inputs and outputs; forms and nature of production function; resources and their allocation to agricultural enterprises; factor interdependence and elasticity of factor substitution; cost and supply functions and their derivation; elasticity and stages of production; fitting of various production curve and derivation of parameters; evaluation of production function estimates; determination of profit maximizing levels of inputs as well as outputs under various market situations; dynamic aspects of production function and production optimization; choices and decision making under risk and uncertain situations; linear programming; theory of insurance and chance taking; vertical as well as horizontal integration of enterprises.

AEC 719 Agribusiness and Management (3+0)

Basic concepts and definitions of firm, plant, industry and their interrelationships with respect to agricultural production; organization and business management functions: financing, operation, production and processing of farm products and their distribution; standardization of agriculturally based final products; problems and prospects of

agribusiness in Nepal; case studies of agricultural firms; industries and model development for their promotion.

AEC 720 Farm Management Economics (2+1)

Farm management and its scope; farm management functions; factors affecting commercial agriculture; development of farm management as a science; principles of production function; farm accountancy - records, record books and record keeping systems; financial analysis of farm records and accounts; planning and optimization of resources with the help of various planning techniques; adjustment of farms under risk and uncertainty; farm efficiency measures and income measurement.
Each student will be assigned a farmer for studying the existing production plans and developing the optimal ones at both existing and improved levels of technology and compare their relative profitability.

AEC 721 (or EXT 721 or AST 721) Statistics for Social Sciences (2+1)

Introduction, concept, and definition of statistics; frequency distribution; classification and tabulation of data; presentation of data; measures of central tendency and dispersion; central limit theorem; variables and their measurements; probability theory and distribution; least square and maximum likelihood methods of estimation; sampling theory and design; sample size distribution; hypothesis testing: parametric and non-parametric test; correlation and regression; regression on dummy variables; introduction to some multivariate analysis techniques; use of logistic and log-linear models; introduction to index numbers; time series analysis; scales and scale construction for qualitative and quantitative data and linear analysis.

2. AGRICULTURAL EXTENSION AND RURAL SOCIOLOGY

Departmental Courses		Credit Hrs.
EXT 701	Extension Education	2+0
EXT 702	Social Psychology	2+0
EXT 703	Social and Cultural Change	2+0
EXT 705	Research Methods in Social Sciences	3+0
EXT 706	Group Dynamics and Leadership	2+0
EXT 707	Contemporary Extension Approaches	2+0
EXT 708	Development Communication	2+0
EXT 709	Theory Construction	2+0
EXT 710	Adult Education in Agriculture	2+0
EXT 711	Program Planning in Agricultural Extension	2+0
EXT 712	Monitoring and Evaluation of Agricultural Extension Programs	2+0
EXT 713	Administration and Management of Agricultural Extension Programs	2+0
EXT 714	Development Sociology	2+0
EXT 715	Approaches and Strategies of Rural Development	2+0
EXT 716	Communication and Information Management Systems	2+1
EXT 717	Communication of Innovation	2+0
EXT 718	Cooperatives and Marketing Extension	1+0
EXT 721	Statistics for Social Sciences	2+1
EXT 790	Special Problem	0+2
EXT 799	M.Sc. Seminar	0+2
EXT 800	M.Sc. Thesis	0+6
EXT 899	Ph.D. Seminar	0+2
EXT 900	Ph.D. Dissertation	0+15

EXT 701 Extension Education (2+0)

Why extension system is necessary? Origin and growth of extension education in historical perspective. Extension education as a professional and as a discipline. Concept, scope, principles, processes, philosophy and objectives of extension education. Need for extension training, extension education and community development. Teaching and learning in extension education. Extension teaching methods. Extension strategies for technology utilization and minimizing risk. Gender issues in extension education. Role of Agricultural College/University.

EXT 702 Social Psychology (2+0)

Introduction of social psychology; social psychological theories; importance of the study of social psychological theories, theories of attitute change and learning, other social psychological theories; socio psychological research: methods of studying social behavior, the experimental and non-experimental methods, principle of triangulation in social research; social self and impression management; social perception: impression and explanation of people; social attitudes and behavioral change; social influence and personal control; personal perception and attribution; social justice: equity, deprivation and

development; social norms, values and belief systems, and rural development; social location of man: society and socialization and social dispute and dispute management.

EXT 703 Social and Cultural Change (2+0)

Conceptualization of social changes and cultural change; factors/causes of social change; the socio-cultural barriers to social changes; patterns of social change; theories of social change; non-violence and violence strategies of social change and the socio-economic and cultural impacts of social change.

AEC 705 (or EXT 705) Research Methods for Social Sciences (3+0)

Nature and types of social research; research process and research designs; sampling and sampling designs; hypothesis and hypothesis testing; parameters and variables; variables and their levels of measurement; scales and scaling techniques; planning social research; methods and techniques of data collection; development of questionnaire and interview schedules; interview and interviewing techniques; coding and management of data; techniques of data analysis and report writing.

EXT 706 Group Dynamics and Leadership (2+0)

An overview of group dynamics as a discipline and its development, some theories, principles and applications from the allied sciences in attitude, behavior, norms conformity and compliance, consistency and cognitive aspects of human behavior. Group development processes and stages, group structuring and interaction process, group process and techniques used in problem solving and decision making, group leadership, power and influence leadership styles, typology, leader behavior – theories, approaches and leader effectiveness. Conflict management sources and resolution techniques.

EXT 707 Contemporary Extension Approaches (2+0)

Alternative models and recent trends in organizing agricultural extension. Approaches of agricultural extension. Comparative analysis of the various approaches. Strength and weaknesses of various extension system. Analysis of national extension systems prevailing in selected countries (India and USA) with emphasis on comparative merits and elements having universal application for strengthening the extension systems in Nepal. General perspective of the world's experience with agricultural extension. Major problems and issues in improving extension effectiveness. Extension service in Nepal, India and USA.

EXT 708 Development Communication (2+0)

Definition, meaning, scope and type of communication, sociological, psychological and cultural perspectives of communication, communication strategies in agricultural development, past and present with large and small community, groups and individuals, action and functional models in agricultural development programs, roles of cooperation, conflict, consensus and congruence, role of public and private organizations in developmental programs, communication systems and their interrelationship and impact on rural development, current communication strategies in agricultural development of Nepal, communication policies linked with national and international agencies, and communication media and society at present and future.

EXT 709 Theory Construction (2+0)

Conceptualizing theory construction and its importance in the study of behavioral sciences; the nature, science and scientific theory; the characteristics of scientific theory; the structure of a social theory; theory- definition and use, parts, definition and problems, theory connections- relationship statements, symbolization, problems, hypothesis statements, and proposition, theory formats, axioms and theorems, explanation and criteria governing formalization of explanatory system; the conceptual and causal analysis; the conceptual and theoretical framework; the relationship between theory and research; social paradigms; structural/functional perspective, conflict perspective, exchange theories, interactionists' approaches, ethnomethodology and phenomenology and system approaches.

EXT 710 Adult Education in Agriculture (2+0)

Introduction to Andragogy and adult education, emerging roles of adult education, recent influences on adult learning theory, social reform, self-determination, Humanist vs. Behaviorist positions, assessing needs and interests in planning adult education programs, designing learning activities, climate setting, objective setting, designing and managing learning experiences, approaches, methods and techniques of teaching adults, development of teaching materials; organizing and administering adult education programs; organizational setting and evaluation of evaluating adult education program.

EXT 711 Program Planning in Agricultural Extension (2+0)

Philosophy and philosophical framework of program planning, concepts and approaches, analysis and review of programming models, planning gains, roles and responsibilities of planners, levels of plan and relationship between various levels, planning methodology, cycle and stages, rural development and extension program planning, people's participation, organizational consideration, situation analysis, need analysis methodology, individual level, community level, priority setting, objectives and levels of objectives, network analysis, networking, PERT, CPM, participatory monitoring and evaluation.

EXT 712 Monitoring and Evaluation of Agricultural Extension Programs (2+0)

Introduction, concept of evaluation and monitoring, principles and functions of evaluation, monitoring and evaluation, evaluation and extension, evaluation and research, evaluation and measurement, types of evaluation, role of objectives in program evaluation, basic terminology, levels and types, taxonomy of educational objectives, criteria for selecting appropriate objectives, methods of stating objectives, techniques and procedure of quantitative and qualitative evaluation, different techniques and procedures, concept and process used in CIPP model, and comparative analysis of other extension program planning evaluation models.

EXT 713 Administration and Management of Agricultural Extension Program (2+0)

Basic concepts, principles and theories of administration and organizational structure, functions, responsibilities, authorities of administration leaders/managers, human resource planning and development, comparative and critical review of administrative/ management styles and techniques specially concepts process and models of participatory approaches in management and administration in agriculture development.

EXT 714 Development Sociology (2+0)

The nature and concepts of development: the definitions of development: socio-economic concepts of development and underdevelopment- modernization, urbanization, acculturation, community development and rural development, progress and progressive, poverty and vicious cycle of poverty; the pre-requisites of national development: psychological readiness of the people, viable socio-economic structures, the political dimensions, natural resource endowments, social justice; the participatory approach of development; two schools of developmental thoughts: development through class conflicts, the Marxist legary, the structural functional perspective of development; the theories of development and underdevelopment.

EXT 715 Approaches and Strategies of Rural Development (2+0)

Conceptualization of rural development, modern strategies of rural development; models of rural development, village development model, community development model, integrated rural development model, integrated area development model, integrated regional development model, approaches of rural development, participatory and non-participatory approaches of rural development, social and cultural context of rural development, modern strategies of rural development, problems and prospects of rural development in the developing countries.

EXT 716 Communication and Information Management Systems (2+1)

Definitions, concepts and scope importance and value of information management functions and managerial work. Contemporary issue in management. Access to information in the developing world: education, literacy and power. Nature, type of information and sources. Information requirement, wants needs and demand. Strategies for information provisions. Information policy and flow in organizations. Organization of information, bibliographic organization and control, information retrieval systems, information service as a resource centre. Document as information career. Library as information and learning resource centre. Computer cataloging, modeling, expert system and database system development, knowledge management. Agricultural business strategy and competitive advantage. Strategic planning process. Information technology (IT) and strategy. IT and organization. Core communication skills, effective information transfer. Public speaking and relations, team work.

Field/work experience shall include.
Construction of a prototype knowledge based system using available software (Crystal).

Development of a working database, demonstrated through a live presentation and the preparation of user and database administrator documentation.
Case studies of agricultural information management systems.

EXT 717 Communication of Innovations (2+0)

Innovation, decision process- perceived attributes of innovations and their role of adoption. Adoption process; different stages of adoption, measures of adoption rate and adoption index, adoption stages and sources of information, adopter's categories, personal, social, situational and cultural characteristics. Attitude, values and social structure; sub-culture and tradition, traditional values and adoption, rural social structure and behavior, leadership and community structure, community factors in adoption of agricultural innovations. Diffusion process; components of diffusion, channels of communication, type of communication, principle of communication, role of communication in extension work, communication strategies, communication bahaviour, barriers of communication. Diffusion of innovation, diffusion curve, characteristics of innovation, role of communication in diffusion process. Society, community, transfer of technology, models of TOT, emerging concepts in TOT. Various programs and approaches to rural development and their advantages and limitations in Nepal.

EXT 718 Cooperatives and Marketing Extension (1+0)

History, development, nature and objectives of cooperatives in agriculture in Nepal and the outside world. Principles and policies of cooperatives and their organizational structures, cooperative enterprises problems and perspective, management and administration of cooperatives societies in Nepal. Definition and organizational set up of marketing, marketing extension and information flow, product planning, processing, and packaging, storage and transportation to markets.

EXT 721 (or AEC 721 or AST 721) Statistics for Social Sciences (2+1)

Introduction, concept, and definition of statistics; frequency distribution; classification and tabulation of data; presentation of data; measures of central tendency and dispersion; central limit theorem; variables and their measurements; probability theory and distribution; least square and maximum likelihood methods of estimation; sampling theory and design; sample size distribution; hypothesis testing: parametric and non-parametric test; correlation and regression; regression on dummy variables; introduction to some multivariate analysis techniques; use of logistic and log-linear models; introduction to index numbers; time series analysis; scales and scale construction for qualitative and quantitative data and linear analysis.

EXT 790 Special Problem: SLA Based on Workshop/Discussion (0+2)

System learning, learning approach to change, ways and levels of learning, experimental learning, action learning, reflection, essence of wholeness, systemic improvement in problematic situation, world views and developmental paradigm, self development, community development and organizational development, course member interested issues etc., i.e. field works or case studies on the issues identified by the Advisory Committee.

3. AGRONOMY

Departmental Courses		Credit Hrs.
AGR 701	Concept of Crop Science	2+1
AGR 702	Cereal Crops	2+1
AGR 703	Pulse and Oilseed Crops	2+1
AGR 704	Commercial Crops	2+1
AGR 705	Weed Management	2+1
AGR 706	Seed Technology	2+1
AGR 707	Cropping Systems	2+1
AGR 708	Crop Management	3+1
AGR 711	Crop Modeling	2+1
AGR 712	Basic of Agricultural System	3+0
AGR 714	Advanced Crop Physiology	2+1
AGR 720	Plant Water Relationship	2+1
AGR 799	M.Sc. Seminar	0+2
AGR 800	M.Sc. Thesis	0+6
AGR 899	Ph.D. Seminar	0+2
AGR 900	Ph.D. Dissertation	0+15

AGR 701 Concept of Crop Science (2+1)

Concept of crop growth analysis; quantitative and agro-biological principles and inverse yield nitrogen law; Mitscherilich's yield equation, its interpretation and applicability; effect of lodging in cereals; physiology of grain yield in cereals; effects of plant type, plant population and planting pattern on crop yield; concept of soil plant relations; tillage concept; zero tillage; dry farming; methods for determining nutrient needs of the crops; and yield potentiality of crop plants.

AGR 702 Cereal Crops (2+1)

Origin, history, area, production, classification, improved varieties, climate, soil, water, and cultural requirements, nutrition, quality components, handling, and constraints and opportunities of paddy, maize, wheat, barley and millets.

AGR 703 Pulse and Oilseed Crops (2+1)

Origin, history; area, production trends, adaptability, classification, improved varieties, climate, soil, water, and cultural requirements, fertilizers, weed control, water management, harvesting, threshing, utilization, place in cropping system, role in human nutrition, soil fertility, and constraints and opportunities of pigeon pea, chickpea, black-gram, green-gram, cowpea, grass pea, lentil, and faba bean.
Origin, history, area, production trends, classification, improved varieties, climate, soil, water, and cultural requirements, utilization, quality components, handling, and constraints, and opportunities of rape and mustard, sesame, linseed, soybean, groundnut, sunflower and niger.

AGR 704 Commercial Crops (2+1)

Introduction, origin, history, production trends, classification, improved varieties, climate, soil, and cultural requirements, fertilizer, weed control, water management, harvesting, post harvest technology, utilization; and constraints and opportunities of production of sugarcane, tobacco, cotton, jute, potato and sugarbeet.

AGR 705 Weed Management (2+1)

Integrated weed management; weed-crop association; neighboring effect of weeds including competition, interference and allelopathy; herbicides - introduction and history of development, classification based on chemical, and physiological application, and selectivity, factors affecting the efficiency of herbicides, herbicide formulation, and herbicide mixtures; aquatic and perennial weed control; parasitic weeds; cost benefit analysis of weed management; weed management in major crops; screening procedure of herbicides; preparation and spray equipments; biostatistical methods in herbicides evaluation; symptoms, and factors affecting herbicide efficiency; and spraying techniques.

AGR 706 Seed Technology (2+1)

Seed dormancy; germination and vigor; factors affecting seed quality; types of seed, and their development; multiplication, certification, and distributions; seed physiology; and seed laws.

AGR 707 Cropping Systems (2+1)

Definition and importance; physical resources; soil and water management; cropping systems; concept of sustainability in cropping systems and farming systems; production potential under sequential cropping; mechanism of yield advantages in intercropping systems; above and below ground interactions and allelopathic effects; competition relations; multi-storied cropping; and yield stability in intercropping.

AGR 708 Crop Management (3+1)

Historical background of crop management; yield attributing characters of crops; factors affecting crop growth and yield including climatic, adaphic, biotic, and socioeconomic; soil productivity and fertility; fertility management; organic manure; inorganic fertilizers; major and minor nutrients; bio-fertilizers; physiological functions of major and minor plant nutrients; role of improved agricultural operations in crop production; tillage; crop planting and cropping systems; water management for crop production; crop production under special situations; recent advances in crop management research in Nepal on rice, wheat, maize, oilseeds, jute, cotton, sugarcane, potato, and grain legumes.

AGR 711 Crop Modeling (2+1)

Philosophy; role and terminology of systems science; basis of crop models; development of crop model structure; algebraic forms; integral differential forms; parameter estimation; computer implementation of crop models; crop models testing and validation; application

of crop models; remote sensing; study of cropping systems and farming systems models, and input models.

AGR 712 (or ANS 712) Basic of Agricultural Systems (3+0)

System approach to agriculture; definition and scope; subsidy and sustainability of agricultural systems with examples; the purpose of agriculture systems; properties of agricultural systems and approaches to understanding them; global environmental changes; agroecosystem analysis, principles, and procedures; understanding crop livestock integration; social system and the institutional support.

AGR 714 (or PPH 714) Advanced Crop Physiology (2+1)

Seed dormancy and germination; growth, development and differentiation in major crop plants; photosynthetic pathways in higher plants; transports and accumulation of photosynthates; nitrogen uptake and assimilation; general basis of biomass accumulation and yields in crops; source and sink relations and their contribution to yield.

AGR 720 (or PPH 720 or HRT 720) Plant Water Relationship (2+1)

Physical structure and properties of water; concepts of water potential; cell water relationship; water movement through soil; plant atmosphere system; uptake and transport of water to roots; plant water status; development of crop water deficits; stomatal pattern and dynamics; atmospheric demand for water; evapotranspiration; water use efficiency; morphological, physiological and agronomical effects of water stress; crop adaptations to water deficits; screening techniques for drought tolerance.

4. BASIC SCIENCE AND HUMANITIES

Departmental Courses		Credit Hrs.
ENG 701	Technical Writing English	2+0
AS T 711	Statistical Methods in Biological Sciences	2+1
AS T 713	Design of Experiments	2+1
AS T 714	Calculus and Matrix Algebra	3+0
AS T 721	Statistical Methods in Social Sciences	2+1
BCH 728	General Biochemistry	2+1

ENG 701 Technical Writing English (2+0)

Use of noun, pronoun, verbs, adverbs, adjectives, tenses, active/passive; Review, English Science, Paragraph and punctuation; Note taking, Information collection, presentation, using tables and figures; Reference citation, Assignment writing.

AST 711 Statistical Methods in Biological Sciences (2+1)

Review of previous statistical course: descriptive and inferential statistics; probability distribution and sampling distribution; least squares and maximum likelihood methods of estimation; tests of hypothesis (F, t and χ^2); correlation and regression (simple and multiple); regression modeling and checking for assumptions; analysis of count and score data; non-parametric methods; introduction to some multivariate methods; design of experiments: CRD, RBD, LSD and split-plot design; considerations to treatment structure and quantitative treatments; analysis of covariance; combined analysis of multi-site and/or multiyear data; stability regression (for plant sciences) and meta-analysis (for animal sciences); analysis of repeated measurements; experiments in farmers' fields; and problem data.

AST 713 Design of Experiments (2+1)

Basic principles of design of experiments; elements of linear estimation, analysis of variance and covariance; completely randomized, randomized block and Latin square designs; factorial experiments; confounding in 2^2 and 3^2 experiments; split-plot and strip-plot designs; balanced incomplete block (BIB) designs (general properties) and their analysis; elementary constructions of BIB designs; partially balanced incomplete block designs; augmented designs; Youden squares; and fractional replication of symmetrical factorials.

AST 714 Calculus and Matrix Algebra (3+0)

Limits, continuity and derivability; differentiation of functions of a single variable; successive differentiation; use of Taylor's and Maclaurin's theorems; and mean value theorem. Tangent and normal, asymptotes, curvature, and points of inflexion; Hadel equation; partial differentiation; maxima and minima of functions of single variable. Integration by simple methods, standard forms, and simple definite integrals; reduction formulae, rectification and quadrature; simple differential equations and their solutions; and Beta and Gamma functions. Matrix algebra, elementary operations, equivalence, inverse

matrix, linear and quadratic forms, transformations, characteristic equations, quadratic forms, determinants, eigenvalues and eigenvectors.

AST 721 (or EXT 721 or AEC 721) Statistics for Social Sciences (2+1)

Introduction, concept, and definition of statistics; frequency distribution; classification and tabulation of data; presentation of data; measures of central tendency and dispersion; central limit theorem; variables and their measurements; probability theory and distribution; least square and maximum likelihood methods of estimation; sampling theory and design; sample size distribution; hypothesis testing: parametric and non-parametric test; correlation and regression; regression on dummy variables; introduction to some multivariate analysis techniques; use of logistic and log-linear models; introduction to index numbers; time series analysis; scales and scale construction for qualitative and quantitative data and linear analysis..

BCH 728 General Biochemistry (2+1)

Introduction, cell organelles - structure and functions; Aqueous medium of the protoplasm, physical properties, biological importance, pH, Henderson-Hassellbalch equation, physiological buffer system; Amino acids and peptides - general properties, structural features, protonic equilibria and ionic structures, the peptide bond, peptides and polypeptides; Protein - solubility classification, structure and function of a protein hemoglobin; enzyme – catalysis, nature of enzymes, specificity, active site and substrate binding enzyme; Hormones – classification and properties, kinetics; bioenergitics – free energy concept, standard energy changes; carbohydrate metabolism; lipids, phospholipids and steroids, bilayer lipid membrane; nucleotide, nucleic acids; protein metabolism; Polarity and non-polarity of biological substances, quantitative estimation and biochemical assay through spectrophotometer, chromatography and electrophoresis; preparation of buffer solutions, detection and quantification; carbohydrates, lipids, proteins and nucleic acids isolation, purification of enzymes, assay of important enzymes, characterization of different biochemical substances through spectrophotometry; Separation and quantification through chromatograph; Electrophoresis for protein and nucleic acid separation.

5. ENTOMOLOGY

Departmental Courses		Credit Hrs.
ENT 701	Insect Morphology	2+1
ENT 702	Insect Physiology	2+1
ENT 703	Insect Ecology	2+1
ENT 704	Insect Taxonomy	1+2
ENT 705	Insect Pest Management	2+1
ENT 706	Insect Toxicology	2+1
ENT 707	Advanced Insect Physiology	2+1
ENT 708	Advanced Insect Ecology	2+1
ENT 709	Advanced Insect Taxonomy	1+2
ENT 710	Taxonomy of Immature Insects	1+1
ENT 711	Insect Pathology	2+1
ENT 712	History of Entomology	2+0
ENT 713	Introduction to Acarology	2+1
ENT 714	Introduction to Biological Control	2+1
ENT 715	Storage Entomology	2+1
ENT 716	Field Crop Entomology	2+1
ENT 717	Horticultural Entomology	2+1
ENT 718	Medical and Veterinary Entomology	2+1
ENT 719	Insect Vectors of Plant Diseases	2+1
ENT 720	Insect Resistance in Crop Plants	2+0
ENT 721	Pesticide Regulations and Environmental Pollution	2+0
ENT 722	Vertebrate Pest Management	1+1
ENT 723	Food Plants of Silkworm	2+1
ENT 724	Silkworm Breeding and Egg Production	2+1
ENT 725	Advanced Apiculture and Crop Pollination	2+1
ENT 726	Advanced Silkworm Rearing and Disease Management	2+1
ENT 727	Advances in Entomology	2+1
ENT 728	Entomological Techniques	1+1
ENT 799	M.Sc. Seminar	0+2
ENT 800	M.Sc. Thesis	0+6
ENT 899	Ph.D. Seminar	0+2
ENT 900	Ph.D. Dissertation	0+15

ENT 701 Insect Morphology (2+1)

Body wall and its structure (including outgrowth); body regions: sclerites and segmentation; head structure and its appendages, thorax, legs and wings, abdomen sclerites, appendages and genitalia, morphogenetical regularities and anagenesis.

ENT 702 Insect Physiology (2+1)

Origin of life; nature and scope of insect physiology; basic phenomena in living organisms; the cell and cell wall respiration; basic physiology of integument and various systems in insects - digestive, circulatory, respiratory, excretory, nervous and

reproduction; physiology of digestion, absorption and metabolism of carbohydrates, lipids and nitrogenous compounds.

ENT 703 Insect Ecology (2+1)

Basic ecological concepts, insect abundance, habitat, distribution, food chain and succession, natural balance theories pertaining to control of insect pests.

ENT 704 Insect Taxonomy (1+2)

Introduction to class insecta and its position in phylum arthropoda; history of classification of insects including evolution; methods of collecting and preserving insects; classification of insects up to families with habit, habitat and economic importance of each group; common terms used in taxonomic nomenclature.

ENT 705 Insect Pest Management (2+1)

Introduction, sampling, monitoring and forecasting; yield loss assessment; insecticides; host plant resistance; natural enemies; cultural control; interference methods; quarantine, legislation and politics; integrated insect pest management.

ENT 706 Insect Toxicology (2+1)

History, use and classification of insecticides, their biological and physical properties; formulation; self life; measurement of toxicity, bioassay techniques; limitations of chemical control- hazards to man, animals and the ecosystem, phytotoxicity, development of resistance in target pests; insect attractants, repellents, antifeedants and chemosterilants; juvenile hormones; and other pesticides.

ENT 707 Advanced Insect Physiology (2+1)

Physiology of endocrine glands and neurosecretions, and their roles in reproduction and metamorphosis, nerve impulse transmission; physiology of sense organs and their mode of functioning; light production; photoperiodism; chemoreception, physiology of migration; insecticide resistance and biochemical basis for resistance; chemical communication in insects; effects of insecticides on various physiological processes.

ENT 708 Advanced Insect Ecology (2+1)

Insect population dynamics, migration, inter and intra specific competition and recent ecological advances.

ENT 709 Advanced Insect Taxonomy (1+2)

Principles of identifying keys for insects; classification of insects up to families of (economically important genus and families of various orders to be dealt) and in some cases up to species.

ENT 710 Taxonomy of Immature Insect (1+1)

Collecting, rearing, killing, fixation, preservation and permanent storage of immature form of insects; morphology and classification of immature forms; identifying immature stages and making field keys; rearing of some important species and studying their behavior.

ENT 711 Insect Pathology (2+1)

Introduction; major phases of insect pathology; interface between insect parasites and pathogens; infection process; insect resistance, biology of microbial agents (bacteria, fungi, viruses, protozoa, nematodes), including their uses for pest control and epizootic in population; techniques in insect pathology, mass rearing and testing of insect pathogens by bioassay, field evaluation and safety of insect pathogens.

ENT 712 History of Entomology (2+0)

History and development of world entomology, eminent entomologists, their contribution in the field of applied and basic entomological development.

ENT 713 Introduction to Acarology (2+1)

Biology and host relationship of mites associated with crop plants and stored products, identification and control of major mite pests in field and storage.

ENT 714 Introduction to Biological Control (2+1)

History and development of biological control, predatory and parasitic groups of biocontrol agents, principles and techniques of biological control of major insect pests.

ENT 715 Storage Entomology (2+1)

Postharvest crop losses and loss assessment studies in stored grains, grain storage structures; biology, behavior and management of insects, mites and rodents in stored food grains, seeds and stored products.

ENT 716 Field Crop Entomology (2+1)

Biology, behavior and management of insect pests of field crops: cereals (rice, maize, wheat, and finger millet), grain legumes (chickpea, pigeonpea, cowpea, blackgram, beans and garden pea), oilseeds (rape, mustard, groundnut, sesame), and cash crops (sugarcane, tobacco, jute and cotton).

ENT 717 Horticultural Entomology (2+1)

Biology, behavior and management of insect and mite pests of vegetable crops: cole crops (cauliflower, cabbage, radish etc.), cucurbitaceous crops (pumpkin, cucumber, watermelon etc.), solanaceous crops (potato, tomato, egg plant, chili) and okra; and fruit crops: mango, banana, litchi, guava, citrus, peach, pear and apple.

ENT 718 Medical and Veterinary Entomology (2+1)

Identification, biology and host relationship of major arthropods affecting man and domestic animals and their management.

ENT 719 Insect Vectors of Plant Diseases (2+1)

Role of vectors in disease transmission, vector-disease-plant relationships, methods of disease transmission and control of plant diseases through vector control.

ENT 720 Insect Resistance in Crop Plants (2+0)

Historical development and importance of host plant resistance, mechanism of resistance, host plant relationships and interactions, insect pest control through resistance of plants, method of selection, and durable resistance in major crop plants.

ENT 721 Pesticide Regulations and Environment Pollution (2+0)

Historical accounts of pesticide development, pesticide formulations, misuse, residues, their fate in environment and ecological consequence, acts and regulations related to pesticide safely and regulatory frameworks.

ENT 722 Vertebrate Pest Management (1+1)

Pre and postharvest losses of crop due to vertebrate pests, biology, nature of damage and management of various vertebrate pests (mammals, monkeys, porcupine, birds, rodents etc.).

ENT 723 Food Plants of Silkworm (2+1)

Introduction, history and scope of food plant cultivation, biological characteristics, breeding, propagation, nursery and field management, harvesting and leaf storage, disease and pest management.

ENT 724 Silkworm Breeding and Egg Production (2+1)

Introduction to breeding and grainage, biological characteristics of silkworm races, silkworm breeding, maintenance of breeding stocks and F_1-hybrid production, quality seed and cocoon production, egg production and disease examination, preservation and artificial hatching of silkworm eggs.

ENT 725 Advanced Apiculture and Crop Pollination (2+1)

World history of bee keeping, ecology, behavior, seasonal management, pest and diseases, relationship of bees with flowering plants, pollination and their role in crop production.

ENT 726 Advanced Silkworm Rearing and Disease Management (2+1)

Historical accounts of silkworm rearing, mulberry and non-mulberry silkworm races, their rearing management, pests and diseases of silkworms and their control.

ENT 727 Advances in Entomology (2+1)

Recent trends, concepts and new approaches in insect pest management; pest modeling, bio-measurements and their applications in pest control; tissue culture, genetic engineering and their applications in crop protection.

ENT 728 Entomological Techniques (1+1)

Microtechnique principles and procedures, insect collection, preservation, labeling and storage, temporary and permanent mountings and staining, photography and histological techniques, mass culture of insect in laboratory and greenhouse for research and entomological studies, scientific writing in entomology.

6. ENVIRONMENTAL SCIENCE

Departmental Courses		Credit Hrs.
PPH 702	Plant Metabolism	2+1
PPH 703	Environmental Plant Physiology	2+1
PPH 705	Physiology of Seeds	2+1
PPH 706	Growth and Development	2+1
PPH 707	Plant Growth Regulators	2+1
PPH 708	Plant Nutrition	2+1
PPH 710	Cell Physiology	2+1
PPH 711	Physiology of Biofertilizers and Biological Nitrogen Fixation	2+1
PPH 712	Laboratory Methods in Botany and Plant Physiology	0+2
PPH 714	Advanced Crop Physiology	2+1
PPH 719	Plant Stress Physiology	2+1
PPH 720	Plant Water Relationship	2+1
(Conservation Ecology)		
COE 701	Conservation Ecology	2+1
COE 702	Microbial Ecology	2+1
COE 703	Ecological Agriculture	2+1
COE 704.	Applied Ethnobotany	2+1
COE 705.	Natural Resource Management	2+0
COE 706.	Wetland Ecology	2+0
COE 707	Biodiversity Management	2+1
COE 708.	Agroecotourism	2+0
COE 709.	System Analysis and Crop Models	2+0
COE 710.	Ecology of Community Forestry	2+0
COE 711.	Weed Biology and Ecology	2+0
COE 712.	Environmental Impact Assessment	2+0
COE 713.	Participatory Innovation Research and Development Studies	2+0
COE 799	M.Sc. Seminar	0+2
COE 800	M.Sc. Thesis	0+6
COE 899	Ph.D. Seminar	0+2
COE 900	Ph.D. Dissertation	0+15

PPH 702 Plant Metabolism (2+1)

Synthesis and degradation of carbohydrates in C_3 plants; respiration needs in plants; energy balance and importance of carbon compensation point; common pathway of carbohydrate, protein and lipid metabolism and role of inorganic minerals, vitamins, and coenzymes in the process of metabolic reactions.

PPH 703 Environmental Plant Physiology (2+1)

Plants and their interactions with environment; ecological parameters, and energetics; photosynthetic adaptations of the plants to the diverse habitats with reference to salt, cold, heat and drought affected areas; aerodynamics of gas exchange between the atmosphere and the plants; plant communities and their productivity; crop plant population in relation to photosynthesis and crop production system.

PPH 705 Physiology of Seeds (2+1)

Importance of seeds in crop production; structure and function of individual parts of seeds; life span and longevity of crop and weed seeds; theories of longevity; parameters to evaluate seed health and vigor testing; mechanisms involved in seed germination; physiology and biochemistry of seeds in the process of deterioration under storage or during harvest; tests for seed viability, physiological and biochemical changes during seed development and maturity; physiological responses of seeds to temperature and light (quality and quantity) and moisture stress during germination; physiological basis of seed dormancy and its release, induction of secondary dormancy in seeds.

PPH 706 Growth and Development (2+1)

An introductory account of growth and development; growth correlations; dynamics of growth processes; growth functions; factors controlling plant growth and development; growth curve; physiology of rooting in cutting; physiology of apical dominance; physiology of flowering, photoperiodism, and vernalization; plant tropism; biological rhythms; physiology of seed and fruit development, fruit maturation and ripening; and physiology of abscission.

PPH 707 Plant Growth Regulators (2+1)

Nomenclature and characterization of auxins, gibberellin, cytokinin, abscisic acid, ethylene and phytochrome and their extraction and bioassay; physiological effects of hormones, growth inhibitors and retardants; role of growth substances in agriculture, horticulture and tissue culture; mode and mechanisms of action of plant growth regulators; herbicides and their mechanisms of action; use of weedicides in agriculture.

PPH 708 Plant Nutrition (2+1)

Mineral elements essential for plant growth and development; sand culture and hydroponics; role of essential elements in growth and metabolism; nutritional disorders caused by deficiency or excess of mineral elements; diagnosis and correction; state of ion in soil; ion antagonism; mechanism of ion uptake, translocation, accumulation and compartmentation; chelates and their importance in plant nutrition; foliar nutrition.

PPH 710 Cell Physiology (2+1)

Cell theory; chemical organization of the cells; cellular organizations in prokaryotes and eukaryotes; organization of plasma membrane and other cell membranes; structure and function of cell organelles; chemical structure and ultrastructure of chromosomes; cell division and its regulation; cell movement; free space and apparent free space in cells; colloidal systems, diffusion, osmosis and inhibition.

PPH 711 Physiology of Biofertilizers and Biological Nitrogen Fixation (2+1)

Biofertilizers and their classification; structure and functions of commonly used biofertilizers; nodule development in leguminous crops; blue-green algal symbiosis;

mycorrhiza, its classification and role in modern agriculture; biological nitrogen fixation and its significance; culture techniques of biofertilizers; problems and prospects of increasing nitrogen fixing efficiency of biofertilizers; inoculation techniques of biofertilizers in cultivation of crops.

PPH 712 Laboratory Methods in Botany and Plant Physiology (0+2)

Demonstration of analytical methods; techniques, experiments, instrumentation, followed by instructions on principles and methodology based on theoretical background for the following laboratory methods – microtechnique, organ and tissue culture, quantitative plant analysis for yield and quality parameters, setting experiments for seed germination and raising seedling in nutrient solutions and sand culture, setting laboratory experiments for studying the effect of moisture stress, salt stress and temperature stress, quantitative and qualitative study of population and community in agro-ecosystems, handling of microscopes of different types, colorimeter, pH meter, electrophoresis, centrifuge, flame photometer, leaf area meter, radiometer, and psychrometer.

PPH 714 (or AGR 714) Advanced Crop Physiology (2+1)

Seed dormancy and germination; growth, development and differentiation in major crop plants; photosysnthetic pathways in higher plants; transports and accumulation of photosynthates; nitrogen uptake and assimilation; general basis of biomass accumulation and yields in crops; source and sink relations and their contribution to yield.

PPH 719 (or HRT 719) Plant Stress Physiology (2+1)

General concepts and types of stresses; morphological, anatomical, physiological and biochemical responses of crop plants to different stresses; and principles and practices of management of stress conditions particularly high and low temperatures, excess water, drought, mineral, salt, mechanical, pollutants such as UV, and other chemicals.

PPH 720 (or AGR 720) Plant Water Relationship (2+1)

Physical structure and properties of water; concepts of water potential; cell water relationship; water movement through soil; plant atmosphere system; uptake and transport of water to roots; plant water status; development of crop water deficits; stomatal pattern and dynamics; atmospheric demand for water; evapotranspiration; water use efficiency; morphological, physiological and agronomical effects of water stress; crop adaptations to water deficits; screening techniques for drought tolerance.

COE 701 Conservation Ecology (2+1)

Introduction to conservation ecology and major ecosystems, understanding the relationship among plants, animals and the environments. Ecological hazards and their causes, consequences and management techniques. Natural resources: nature and status, causes of nature resource depletion and consequences, and efforts and approaches to conserve the resources, theories and methods of management of ecosystems, species and genetic diversity, *in-situ* and *ex-situ* conservation areas. Organizations and conservation education and research in Nepal: analysis of achievements and gaps.

COE 702 Microbial Ecology (2+1)

Biology and ecology of microbes and their relationship with human, plants, animals and environment. Recent trends in microbial ecology education and research in developing and developed countries. Application of microbial ecology in environmental conservation and management: understanding relationships between mycorrhiza and plant, human and plant pathogenic microorganism, and role of microbes in the degradation of environmental pollutants, activated sludge, and trickling filter, biocontrol of soil borne pathogens, biofertilizer and their mass production. Impact of pesticides and other environmental pollutants and useful microorganisms.

COE 703 Ecological Agriculture (2+1)

Nature, functions and ecological processes, conservation strategies of agricultural ecosystems of Nepal and world. Nature, physical and social structure (means of livelihood and prosperity) and exchange of mass and energy in agricultural ecosystems. Ecological concepts in agricultural development; Nepalese agriculture and its prospective. Agriculture and other resources: agriculture and soil resource; agriculture and water resource; agriculture and social environment; and agriculture and environmental issues. Sustainable agriculture: recent trends and advances, a concept and an approach of integrated farming, organic farming, biodynamic farming; permaculture; conservation farming; ecological agriculture in Nepalese context.

COE 704 Applied Ethnobotany (2+1)

History, meaning, scope and prospects of ethnobotany. Methodologies and approaches in ethnobotany Ecological ethnobotany: Relationship of humans with natural environment; role of culture in ecological systems. Cognitive ethnobotany: Survey and theory of human cultural perceptions of plants and plant environments and patterns of interactions that can be observed across cultures. Folk classification and nomenclature systems, dynamics of knowledge about plants, and traditional education systems for learning about plants. Traditional botanical knowledge: wild plant resources for medicines, fibers, fodders, dyes, etc, domesticated plants and traditional agriculture; use of plants in material culture, traditional phytochemistry. Application of ethnobotany for sustainable management, commercialization and conservation of plant resources, conservation of food plants, ethnomedicines and other non-timber forest products. Ethics and law: international conventions, ethical dilemmas in trade, physical and intellectual property rights, patents and ownership

COE 705 Natural Resource Management (2+0)

Introduction to natural resources: Concepts, types and role of natural resource, natural resources and environment, natural resources and property right regime. Economic aspects of natural resources: natural resources and economic development, management of demand and supply, production and consumption equilibrium of natural resource management, cost benefit analysis, valuation techniques of non-marketable goods and services, green accounting and its application in environmental protection, market/government failures and their implication to natural resources, basis of economic policy related to natural resource management, poverty and natural resource management.

Managing natural resources: Command and control, recent policy responses to sustainable resource management, co-management, community participation, private resource management, state and natural resource management, management of common and open access resources, empowerment and polycentric governance, decentralized resource management, gender role in natural resource management, pollution and its control/management, management of biological/agricultural recourses, participatory approach of natural resource management. Sustainable development: the quest of sustainable development, the challenge of today in relation to natural resources and sustainable development, role of legislation in protecting natural resources, national legislations in protecting natural resources, environmental justice and natural resources.

COE 706 Wetland Ecology (2+0)

Concepts, scope and types of wetlands. Origin, feature, biology, geochemistry, physics, values, functions and productivity of wetlands. Limnology, river systems, hydro-development, water pollution and eutrophication. Wetland flora, fauna, and agriculture in Nepal and south Asia. Conservation and management of wetlands: World conventions on wetlands, legal aspects of wetland conservation, institutions and capability in wetland management; Awareness and community involvement in wetland management.

COE 707 Biodiversity Management (2+1)

Biodiversity and levels of organization: genes, individuals, populations, communities, and ecosystems. Dynamics of population and communities, problems associated with declining population, managing population and communities for conservation. Global warming and climate change. Species conservation: concept, measuring the risk of extinction, recovery programs, translocations and captive breeding; the role of health and disease monitoring, risk of diseases in threatened species; disease prevention and vaccination. Ecosystem functions and biodiversity; the balance of nature; stability, resilience, succession, and redundancy. Plant-animal interactions and keystone species. Ecosystem management: source-sink strategies, restoration ecology and globalization; conservation and conflict, formal conservation measures and the exclusion of communities; participatory biodiversity management, models of community based conservation. Conflict and nature of politics: human-animal conflict, park and people conflicts and management. Biodiversity laws and conventions.

COE 708 Agroecotourism (2+0)

Concepts, principles, types and status of tourism, ecotourism and farm tourism. Trends in ecotourism and farm tourism growth and activities in protected areas and farming systems, symbiosis and conflicts. Carrying capacity, tourism/recreation opportunity spectrum, limits of acceptable change, visitors impact assessment, and measuring tourism demand. Components of agroecotourism; protected areas, Nepalese farming systems, their management and planning, identifying agroecotourism potentiality and products development, in rural areas using participatory approaches. Designing infrastructure, recreational, and interpretational facilities and code-of-conducts. Community awareness, mobilization and organization, institutional strengthening and capacity building, networking with market, publicity and delivery of tourism products. Managing tourism impacts, measurement and mitigating negative impacts, and enhancing positive impacts.

COE 709 System Analysis and Crop Models (2+0)

Concept and prospects of crop models; types of models (Empirical, Mechanistics, Phenological, Stochastic); yield estimation: potential, water limited, nutrient limited; crop management strategies: planting, nutrients, irrigation, plant protection; Climatic variability and agriculture and its future prospects; integrated models.

COE 710 Ecology of Community Forestry (2+0)

Concepts, history, practices, and evaluation of community forestry; relationship of humans with community forests and their environments; Comparative study of community forests and natural forests. Principles and objectives of community forestry and its role in community development and capacity building through social mobilization. Role of GOs, NGOs, INGOs, CBOs and local governance in community forestry development. Management for wise use of resources (ecotourism, biodiversity, NTFPs and herbal uses). Conflict management in community forestry for the sustainable use of resources. Evaluation of community managed forestry.

COE 711 Weed Biology and Ecology (2+0)

Concept, characteristics, origin and evolution, classification and impacts of weeds; methods for weed biology and ecology; crop-weed competition: critical period of competition and critical threshold level, factors affecting the competitive ability; crop-weed allelopathy. Weed establishment and development in agroecosystems: weed reserves in the soil, viability of weed seeds, dormancy, germination, seedling growth and development; colonization, invasion, succession and interactions. Population ecology: basic concepts of ecosystems with special reference to agroecosystems: weed population dynamics with respect to crop management (cultivation practices, cropping systems, change in crop variety, change in water management, fertilizer management); development of resistance to herbicides.

COE 712/HRT 712 Environmental Impact Assessment (2+0)

Introduction and concepts; establishing the environmental baselines; pre-feasibility stage, feasibility stage during project cycle; EIA methodology; impact prediction, evaluation and comparisons of alternatives; monitoring; mitigation measures; compliance and enforcement; role of civil society; integrative impact assessment; legal measures.

COE 713 Participatory Innovation Research and Development Studies (2+1)

Introduction to participatory research and development on local knowledge and innovation. Concepts of local innovation in research and development, introduction to local innovations of Nepal and global. Understanding vision, mission, objectives of PROLINNOVA International and Country programs. Documentation methods of local innovation; data handling and analysis; developing, maintaining and managing database. Concepts and rationale of participatory research in innovation development; joint experimentation, experimental design, role of statistics in experimentation and data analysis. Concepts, principles and methods of PM&E and impact assessment, data collection and analysis and reporting. Concepts, significance, historical development,

establishment and management of LISF, LISF granting process; capacity building and fund management and reporting. Importance and methods of raising awareness about and recognition of local innovation and innovators; institutionalizing PID and LISF at farming community level and building their capacity for self-managing and sustaining at local level. Importance of partnership and networking for the promotion, joint implementation and dissemination; modalities of partnership; ways of networking; local innovation network and for a for exchanging expertize and experiences and lobbing. Ethics of research and development studies on local innovations; policy and legal support of local innovation; IPR protection; importance and means of advocacy

7. HORTICULTURE

Departmental Courses		Credit Hrs.
HRT 701	Advanced Pomology	2+0
HRT 702	Advanced Olericulture	2+0
HRT 703	Landscape and Ornamental Horticulture	1+1
HRT 704	Horticultural Laboratory Techniques	0+2
HRT 705	Ecological Horticulture	1+0
HRT 706	Growth and Development of Horticultural Crops	2+0
HRT 707	Postharvest Physiology of Horticultural Crops	2+0
HRT 708	Processing and Preservation of Horticultural Crops	1+1
HRT 709	Plant Propagation and Nursery Management	1+1
HRT 710	Plantation Crops, Spices and Condiments	2+0
HRT 711	Potato and Tuber Crops	1+1
HRT 712	Environmental Impact Assessment	2+0
HRT 713	Vegetable Seed Production and Technology	2+1
HRT 714	Plant Genetic Resources	2+0
HRT 715	Breeding of Vegetable Crops	1+1
HRT 716	Breeding of Fruit Crops	1+1
HRT 717	Breeding of Ornamental Plants	1+1
HRT 719	Plant Stress Physiology	2+1
HRT 720	Plant Water Relationship	2+1
HRT 721	Mineral Nutrition of Horticultural Crops	2+0
HRT 722	Tissue Culture of Horticultural Plants	1+1
HRT 723	Plant Biotechnology	3+0
HRT 730	Agroforestry	2+0
HRT 791	Case Studies in Horticultural Crops	0+1
HRT 799	M.Sc. Seminar	0+2
HRT 800	M.Sc. Thesis	0+6
HRT 899	Ph.D. Seminar	0+2
HRT 900	Ph.D. Dissertation	0+15

HRT 701 Advanced Pomology (2+0)

History and development of fruit research in Nepal; biennial bearing; rootstock and its effects on growth and development of apple, citrus, mango and other fruits; decline in fruits, especially citrus, apple, pear, papaya, and banana; sex expression and associated factors; tree structure and canopy management through training and pruning; pollination and incompatibility problem; flowering and fruiting phenomena; high density planting; methods and approaches of varietal development; and scope for further improvement including fruit germplasm management.

HRT 702 Advanced Olericulture (2+0)

Status, prospects and constraints; variety and ecozoning; nutritional and water requirements; cropping systems and off-season production; growth manipulation; integrated pest management of major vegetables of Nepal; and recent advances in vegetable production.

HRT 703 Landscape and Ornamental Horticulture (1+1)

Floriculture and its scope in Nepal; production, propagation, handling, marketing, and associated problems of important cut flowers and potted plants; postharvest management; role of plant growth regulators in floriculture; floral arrangements and Bonsai making; designing, developing and maintaining gardens and landscape areas; and interioscaping.

HRT 704 Horticultural Laboratory Techniques (0+2)

The students will perform a project on any two of the following areas and review recent techniques and development on all three. Plant tissue culture: perform all processes from selection of plant material to regeneration of daughter plants through callus culture.
Post harvest physiology: accomplish different physico-chemical changes during fruit development including pigments, TSS, TA, C_2H_4, O_2, and CO_2 measurements on horticultural produce. Plant tissue analysis: perform tissue analysis for essential elements on horticultural plants, and correlate the contents with nutritional requirements.

HRT 705 Ecological Horticulture (1+0)

Himalayan ecology; ecosystem concepts and environmental resource management; major environmental problems of Nepal; principles of ecological horticulture; analysis of agroecosystem; sustainable agriculture; mountain perspective and sustainability; agroecozonation and horticulture development; and horticulture and sustainable land-use systems.

HRT 706 Growth and Development of Horticultural Crops (2+0)

Terms, concepts, patterns and kinetics of growth in cells, tissues, organs and whole plants; mathematical analysis of the time course of growth; growth and its periodicities; problems of relative growth rate; mechanisms of controlling cellular differentiation; auxins, gibberellin, cytokinin, inhibitors, ethylene and phytochrome with respect to their discovery, chemical structures, biosynthesis and metabolism, transport mechanisms, physiological effects, mechanisms of actions; and quantitative changes in hormonal contents during development; physiological aspects of rooting, dormancy, flowering, fruit set and development, senescence and abscision.

HRT 707 Postharvest Physiology of Horticultural Crops (2+0)

Importance of postharvest horticulture; physiological differences between attached and detached organs; respiration and ethylene production; maturity indices; harvesting and postharvest handling practices; causes of deterioration; physiological disorders, diseases, insect pests, and their control measures; storage and marketing of perishable crops; and controlled ripening of fruits.

HRT 708 Processing and Preservation of Horticultural Crops (1+1)

Processing of horticultural crops; methods of preservation; different kinds of preservatives and their uses; canning and bottling; drying and dehydration; and principles and practices of making juice, jam, jelly, marmalade, ketchup, pickles, murabba, etc.

HRT 709 Plant Propagation and Nursery Management (1+1)

Fundamental principles of plant propagation by seed, cutting, layering and grafting; stock-scion relationships; commercial methods of propagation in fruits, vegetables and flower plants; propagation media and structures; use of plant growth regulators in propagation; management of commercial nurseries; and production of horticultural plants under protected conditions.

HRT 710 Plantation Crops, Spices and Condiments (2+0)

Prospects and status of plantation crops, spices, and condiments in Nepal and south Asia; classification and nomenclature; cropping systems and production management; varietal improvement programs and techniques; postharvest operations and marketing; production constraints; and research advancements.

HRT 711 Potato and Tuber Crops (1+1)

Origin, distribution, status, prospects and constraints; physiology, genetics, breeding methods and responses to environmental factors of the potato and other tuber crops – sweet potato, cassava, taro and yam. Advances in yield improvements, crop management and post harvest, seed potato production of potato and other tuber crops.

HRT 712 (or COE 712) Environmental Impact Assessment (2+0)

Introduction and concepts; establishing the environmental baselines; pre-feasibility stage, feasibility stage during project cycle; EIA methodology; impact prediction, evaluation and comparisons of alternatives; monitoring; mitigation measures; compliance and enforcement; role of civil society; integrative impact assessment; legal measures.

HRT 713 Vegetable Seed Production Technology (2+1)

Status and scope of vegetable seed production in Nepal; principles of vegetable seed production, processing and storage; seed testing; seed production technology of major vegetable crops (cauliflower, cabbage, broccoli, radish, carrot, turnip, rayo, swisschard, onion, cucumber, watermelon, peas, beans, tomato, brinjal, chili and sweet pepper); hybrid seed production and maintenance of inbred lines; distribution and marketing of seeds; and seed certification and legislation.

HRT 714 Plant Genetic Resources (2+0)

Plant genetic resources and biodiversity; agriculture and biological conservation; genetics and conservation; theory and conceptual issues; convention of biodiversity (CBD) and benefit sharing. Sui-generic system, and intellectual property rights; biotechnology and crop genetic improvement; plant exploration and collection, introduction and exchange; and status of plant genetic resources and documentation in Nepal.

HRT 715 Breeding of Vegetable Crops (1+1)

Importance and scope of vegetable breeding; breeding systems in vegetable crops; centers of origin; cytogenetic and breeding techniques for improvement of major winter (cauliflower, cabbage, onion, radish, carrot, and garden pea) and summer (tomato, brinjal, cucumber, squash, French bean, okra and gourds) vegetables; and exploitation of heterosis, mutation and polyploidy.

HRT 716 Breeding of Fruit Crops (1+1)

Importance and scope of fruit breeding; causes of variation in fruit crops; problems and peculiarities in breeding of fruit crops; origin of fruit species and varieties; incompatibility and sterility problems; traditional and modern techniques of fruit breeding; mutation and polyploidy; varietal situation; breeding procedure; and breeding priorities and advances made in major fruit crops - mango, banana, citrus, apple, grape, papaya, litchi and guava.

HRT 717 Breeding of Ornamental Plants (1+1)

History of improvements of ornamental plants; variation in genetic mechanisms associated with flower characters in important annuals, bulbs, and shrubs; breeding systems and methods; role of incompatibility, sterility, polyploidy and mutation in the evolution of new variety; role of heterosis and its exploitation; hybrid seed production; and improvement of major ornamental crops - rose, chrysanthemum, gladiolus, carnation, tube rose, dahlia, marigold, and orchids.

HRT 719 (or PPH 719) Plant Stress Physiology (2+1)

General concepts and types of stresses; morphological, anatomical, physiological and biochemical responses of crop plants to different stresses; and principles and practices of management of stress conditions particularly high and low temperatures, excess water, drought, mineral, salt, mechanical, pollutants such as UV, and other chemicals.

HRT 720 (or AGR 720 or PPH 720) Plant Water Relationship (2+1)

Physical structure and properties of water; concepts of water potential; cell water relationship; water movement through soil; plant atmosphere system; uptake and transport of water to roots; plant water status; development of crop water deficits; stomatal pattern and dynamics; atmospheric demand for water; evapotranspiration; water use efficiency; morphological, physiological and agronomical effects of water stress; crop adaptations to water deficits; screening techniques for drought tolerance.

HRT 721 Mineral Nutrition of Horticultural Crops (2+0)

Role of essential elements with reference to the production of fruits, vegetables and ornamentals; absorption, uptake, and transport mechanisms; metabolism of essential elements and their effects on plant processes; deficiency and toxicity symptoms; plant tissue analysis as a diagnostic technique for nutrient requirements; nutritional status of horticultural crops of Nepal; and concepts and applications of foliar feeding.

HRT 722 Tissue Culture of Horticultural Plants (1+1)

Concepts, and types; media and equipments; sterilization, culturing and factors affecting tissue culture; clonal micropropagation and disease free plant production; callus culture and morphogenesis; somaclonal variation; and cryopreservation.

HRT 723 (or PLB 723) Plant Biotechnology (3+0)

Biotechnology- an overview; review of DNA structure; history of biotechnology; genetic engineering and gene cloning; transferring genes into plants; plant cell and tissue culture; agricultural biotechnology; agrobiodiversity and biotechnology; environment and biotechnology; ethical issues in biotechnology; molecular techniques used in plant breeding including DNA extraction and restriction, gel electrophoresis, PCR, RAPD, RFLD, AFLP, microsatellite; molecular data analysis; phylogenetic studies using molecular techniques; chromosomal maps of field crops; gene tagging and mapping; and examples of markers-assisted selection in crops.

HRT 730 Agroforestry (2+0)

Need of agroforestry in Nepal; overview of land use systems related to agroforestry; recent trends on diagnosis and design of agroforestry systems; criteria for multipurpose tree selection and their integration in different land use systems; field experimentation in agroforestry; and analysis of vegetation degradation.

HRT 791 Case Studies in Horticultural Crops (0+1)

Examination and analysis of a given agricultural systems aiming at identifying constraints/exploring the potentialities of horticultural crops. The analysis will be done in holistic approach, considering natural resources, demographic and socioeconomic factors. Formulation of alternative strategies through field trips, data collection, group's discussions and report writing followed by seminar presentation. Emphasis will be given on participatory methods during identifying and analyzing the problems.

8. PLANT BREEDING

Departmental Courses		Credit Hrs.
PLB 701	Principles of Plant Breeding I	2+1
PLB 702	Principles of Plant Breeding II	2+1
PLB 703	Advanced Genetics and Cytogentics	2+1
PLB 705	Germplasm Collection, Evaluation and Utilization	2+1
PLB 706	Advanced Plant Breeding	3+0
PLB 707	Molecular Genetics	3+0
PLB 713	Population Genetics	3+0
PLB 715	Quantitative Genetics	3+0
PLB 722	Tissue Culture in Crop Improvement	2+1
PLB 723	Plant Biotechnology	3+0
PLB 799	M.Sc. Seminar	0+2
PLB 800	M.Sc. Thesis	0+6
PLB 899	Ph.D. Seminar	0+2
PLB 900	Ph.D. Dissertation	0+15

PLB 701 Principles of Plant Breeding I (2+1)

Nature, goals, achievements, and planning breeding programs; reproductive systems; centers of diversity and origin of plants; genetic basis of variation; methods of breeding self-pollinated crops; methods of breeding cross-pollinated crops; modifications in breeding methods; breeding for plant type, maturity; yield, yield components, morpho-physiological traits, soil and climatic stresses, quality, and resistance to insect-pests and diseases; and development of synthetic varieties, multilines, and composites.

PLB 702 Principles of Plant Breeding II (2+1)

Application of genetics and cytogenetics in plant breeding; mutation breeding; breeding polyploids; wide hybridization; breeding asexually propagated species; utilization of heterosis and development of hybrid varieties; novel breeding approaches; selection for multiple traits; genotype by environment interactions; and selection for quantitative traits.

PLB 703 Advanced Genetics and Cytogenetics (2+1)

Classical concepts relating to identification, transmission, distribution, arrangement, functions, and modification of genetic material; behavior of chromosomes; cellular organelles and cytoplasm in relation to genetic behavior; and chromosomal aberrations and their use.

PLB 705 Germplasm Collection, Evaluation and Utilization (2+1)

Population structure; adaptation to environment; polymorphism; allozyme variation; concepts of center of diversity; methods of field collection; phenotypic evaluation; cataloguing; storage and retrieval of information; and germplasm conservation.

PLB 706 Advanced Plant Breeding (3+0)

Relationship of quantitative genetics, cytogenetics, tissue culture, physiology, and biochemistry to plant breeding; an in depth examination of breeding philosophies; study and analyses of classical works and new trends in plant breeding.

PLB 707 Molecular Genetics (3+0)

Recombinant DNA; gene transfer and manipulation; *ti* plasmid and other vectors; gene regulation and expression; and the state-of-art of biotechnology in the area of plant breeding and molecular markers.

PLB 713 Population Genetics (3+0)

Population structures; path analysis; inbreeding systems; mating designs; formulation of selection indices; correlated responses; higher order genetic interactions; and components of variances in genotype by environment interactions.

PLB 715 Quantitative Genetics (3+0)

Population structures; gene and genotype frequencies; forces changing gene frequencies; variances and covariances; heritability; coancestry; information from relatives; breeding values; gene substitution; selection responses and limit to selection; selection procedures; GxE interaction.

PLB 722 Tissue Culture in Crop Improvement (2+1)

Use of tissue culture; culture media; micro-propagation, its type and requirements; protoplast culture media; suspension culture; callus induction; morphogenesis; embryogenesis; aseptic techniques; application of tissue culture in crop improvement; and cold storage and cryopreservation; somatic hybridization; and somaclonal variation.

PLB 723 (or HRT 723) Plant Biotechnology (3+0)

Biotechnology- an overview; review of DNA structure; history of biotechnology; genetic engineering and gene cloning; transferring genes into plants; plant cell and tissue culture; agricultural biotechnology; agrobiodiversity and biotechnology; environment and biotechnology; ethical issues in biotechnology; molecular techniques used in plant breeding including DNA extraction and restriction, gel electrophoresis, PCR, RAPD, RFLD, AFLP, microsatellite; molecular data analysis; phylogenetic studies using molecular techniques; chromosomal maps of field crops; gene tagging and mapping; and examples of markers-assisted selection in crops.

9. PLANT PATHOLOGY

Departmental Courses		Credit Hrs.
PLP 701	Diseases of Field and Plantation Crops	2+1
PLP 702	Diseases of Fruits, Vegetable, Spices & Ornamental Plants	2+1
PLP 703	Mycology	3+1
PLP 704	Bacteriology	2+1
PLP 705	Nematology	2+1
PLP 706	Virology	2+1
PLP 707	Plant Pathological Techniques & Plant Disease Diagnosis	0+2
PLP 708	Principles of Plant Pathology	3+0
PLP 709	Chemicals in Plant Disease Control	2+1
PLP 710	Epidemiology of Plant Diseases	2+0
PLP 711	Biological and Integrated Plant Disease Management	2+1
PLP 712	Ecology of Soilborne Plant Pathogens	2+1
PLP 713	Seed and Postharvest Pathology	2+1
PLP 714	Disease Resistance in Plants	2+1
PLP 715	Advanced Mycology	2+1
PLP 716	Advanced Bacteriology	1+1
PLP 717	Advanced Nematology	1+1
PLP 718	Advanced Virology	1+1
PLP 719	Advances in Plant Pathology	2+0
PLP 799	M.Sc. Seminar	0+2
PLP 800	M.Sc. Thesis	0+6
PLP 899	Ph.D. Seminar	0+2
PLP 900	Ph.D. Dissertation	0+15

PLP 701 Diseases of Field and Plantation Crops (2+1)

Symptoms, etiology and management of major diseases of cereals (rice, wheat, maize, barley, millet), pulses (pigeon pea, lentil, gram, mung bean); oilseeds (mustard, groundnut, sesame, linseed and soybean); industrial crops (sugarcane, jute and cotton); forage crops (teosinte, berseem, lucerne, para, napier) and plantation crops (tea, coffee, rubber) with special reference to Nepal.

PLP 702 Diseases of Fruits, Vegetables, Spices and Ornamental Plants (2+1)

Symptoms, etiology and management of important disease of fruit crops- mango, banana, guava, litchi, jackfruit, pineapple, papaya, citrus, pear, peach, plum, pomegranate, apple and cherry; vegetable crops- cole crops, crucifers, cucurbits, gourds, brinjal, colocasia, pea, lady's finger, potato, tomato, yam and onion; spices- zinger, garlic, turmeric, cardamom, cinnamon, coriander; ornamental plants annuals and perennials plants and lawn.

PLP 703 Mycology (3+1)

History, occurrence, distribution, importance, taxonomy, modern concepts of classification of fungi; critical account of different groups of fungi upto genus level belonging to sub-division mastigomycotina, zygomycotina, ascomycotina, basidiomycotina and deuteromycotina with special emphasis on general characteristics, ultrastructures, somatic structures, nuclear division, nutrition, growth, reproduction, phylogeny, compatibility, life cycle.

PLP 704 Bacteriology (2+1)

History, occurrence, distribution, importance general characteristics, classification and nomenclature of bacteria and bacteria like organisms such as rickettsia critical accounts of different groups of plant pathogenic bacteria up to generic level with special emphasis on morphology, staining reactions, cultural, physiological, biochemical, serological, transmission, reproduction, physiology, ecology, epidemiology, forecasting different bacterial diseases of crop plants and their management, bacteriophages, their structure, morphology, multiplication and their uses in bacterial disease control.

PLP 705 Nematology (2+1)

History and economic importance of plant parasitic nematodes; morphology, taxonomy, physiology, ecology and pathogenesis of plant parasitic nematodes; relationship of nematodes with other plant pathogens; symptomatology, epidemiology and management of nematode diseases of crop plants.

PLP 706 Virology (2+1)

History and economic importance of plant viruses; nature, properties, classification and nomenclature of plant viruses; and mycoplasma spiroplasm viroids structure, multiplication, purification and transmission of plant viruses with special reference to insect vectors; immunity and serological reactions; variation, mutation and formation of new strains; general symptoms and management of plant virus diseases; mycoplasma, its nature, structure, multiplication and relation with plant diseases.

PLP 707 Plant Pathology Techniques and Plant Disease Diagnosis (0+2)

Familiarization of laboratory equipments, their handling and use; microscopy; preparation of culture media; methods to prove Koch's postulates with fungi, bacteria, virus and nematode; pure culture techniques and maintenance of plant pathogens isolating from plant and soil; techniques for studying physiology of host-pathogen interaction; techniques for scoring diseases and estimation of losses. Diagnosis of infectious and noninfectious plant diseases based on symtomatology, identification of fungal, bacterial, viral and nematode diseases.

PLP 708 Principles of Plant Pathology (3+0)

History of plant pathology, concept, importance, nature and classification of plant diseases; parasitism and disease development, plant disease losses and their appraisal;

environmental factors for parasitic disease development; production, liberation, dissemination, and survival of plant pathogens; phenomenon of infection, enzymes, growth regulations and toxins in pathogens; defense mechanisms, nutritional deficiencies and abnormality, tolerance, resistance and susceptibility. Gene for gene hypothesis, durable resistance, physiological specialization, epidemiology, principles of plant disease management.

PLP 709 Chemicals in Plant Disease Control (2+1)

History and classification of fungicides; nematicides, antibiotics and other chemicals, mode of action and environmental interaction of inorganic, organic, systemic, nonsystemic fungicides; nematicides, antibiotics and their utility and compatibility with other fungicides/antibiotics.

PLP 710 Epidemiology of Plant Diseases (2+0)

Basic concepts of epidemiology, development of plant disease epidemics factors affecting epidemics, monitoring epidemics (host, environment, pathogen, disease), modeling and data analysis, prediction and analysis of epidemics, disease intensity, severity, disease progress curves; temporal vs. spatial plant disease epidemics, simulation models of plant diseases.

PLP 711 Biological and Integrated Plant Diseases Management (2+1)

History, taxonomy and morphology of important biocontrol agents; mechanisms of biological control, delivery techniques and survival of biological control agents in soil; disease control through cultural and other practices; chemicals; tillage, rotation, irrigation fertilization etc.; concept of integrated control, successful evidences of integrated control; Examples of some of the control practices in Nepal.

PLP 712 Ecology of Soilborne Plant Pathogens (2+1)

Ecological concepts, soil environments, including soil water, temperature, aeration, rhizoplane and rhizosphere soil flora and fauna, the biocomplex, parasitic behavior and factors affecting root pathogens; survival and dormancy of soil pathogens; soil mycorrhiza and their role in controlling diseases, root disease management by modification of soil environment, disease suppression and fungistasis.

PLP 713 Seed and Postharvest Pathology (2+1)

History and importance of seed and postharvest pathology; discussion on seedborne and post harvest pathogens; methods of seed health testing identification of important seedborne and postharvest diseases; deterioration of stored grains fruits and vegetables by various pathogens; production of mycotoxies; seed certification; principles and methods of controlling seedborne and postharvest diseases.

PLP 714 Diseases Resistance in Plants (2+1)

Variability in plant pathogens, recognition, relationship between host and pathogen; types of resistance, morphological characters and physiological reactions involved in diseases resistance; identification of source of resistance; genetics of disease resistance; molecular theory of disease resistance.

PLP 715 Advanced Mycology (2+1)

Fungal cell and its chemical composition, growth and development, dormancy, sporulation, nutrition and metabolism in fungi, production of enzymes, toxins and other metabolites, physiological variation and development of new strains, mutation and loss of virulence; molecular basis of mycology.

PLP 716 Advanced Bacteriology (1+1)

Advanced discussion on taxonomy, physiology and ecology of plant pathogenic bacteria and their epidemiological relations, bacterial genetics and variability, bacteriocin and their role in plant diseases, phages of phytopathogenic bacteria; molecular phytobacteriology.

PLP 717 Advanced Nematology (1+1)

Biology and ecology of plant parasitic nematodes, advanced study on host parasite relationship, physiology and genetics of plant pathogenic nematode, integrated management of phytonematodes.

PLP 718 Advanced Virology (1+1)

Architecture and classification of plant viruses, induction of diseases, factors affecting the course of infection and disease development, recent advances in insect vector relationship, physiology of virus infected plants purification of satellite viruses, virus inhibitors, molecular basis of phytovirology, advanced technology in plant virus diseases management. Virus-vector relationship, viruses as biotechnology tools.

PLP 719 Advances in Plant Pathology (2+0)

Gene for gene hypothesis, genomic library, molecular marker for identification of resistant gene, advanced enzymology, development of transgenic plants, other recent advances in plant pathology.

10. SOIL SCIENCE

Departmental Courses		Credit Hrs.
SSC 701	Soil Physics	1+1
SSC 702	Land Degradation and Watershed Management	3+0
SSC 703	Soil Fertility and Plant Nutrition	2+1
SSC 704	Soil Classification and Mapping	1+1
SSC 705	Chemistry of Soil Fertility	2+0
SSC 706	Soil Microbiology	2+0
SSC 707	Soil, Water and Plant Analysis	0+1
SSC 708	Chemistry of Soil Organic Matter	2+1
SSC 709	Micronutrients in Soils and Plants	2+1
SSC 710	Chemistry of Submerged Soils	2+1
SSC 711	Soil Test and Crop Response	2+1
SSC 712	Land Use Planning and Management	1+1
SSC 713	Pollution of Soil Environment	2+0
SSC 714	Remote Sensing and GIS in Soil and Agriculture	1+1
SSC 799	M.Sc. Seminar	0+2
SSC 800	M.Sc. Thesis	0+6
SSC 899	Ph.D. Seminar	0+2
SSC 900	Ph.D. Dissertation	0+15

SSC 701 Soil Physics (1+1)

Physical properties of soil in relation to solute, water and heat movement; potential energy of soil water; flow of water in saturated and unsaturated soils; model of infiltration measurement; soil aeration in relation to respiration and drainage; movement and control of soil heat; transport of dissolved solutes; traditional and modern approach of tillage and soil structural management; classical and newer concepts of soil-water availability to plants. Water contents at wilting point, field capacity and saturated conditions; measurement of soil water potentials; development of soil-moisture characteristic curves for coarse and fine soils; hydraulic conductivity of saturated soils; measurement of mechanical impedance of soils; infiltration rates.

SSC 702 Land Degradation and Watershed Management (3+0)

Land degradation: Himalayan environmental degradation; resource use depletion; concept of sustainable development; trend on land degradation and desertification; effects of land degradation on agriculture, forestry and water regime; flooding and silting up of rivers, dams, etc.; pollution by industrial wastes; effects of air pollution on plants, animals and human health; acid rains - effects on plants, soils, and lakes.

Watershed management: Physiographic and/or ecological zones of Nepal; major river systems, watersheds and their conditions; land use and land capability classification; integrated watershed management, people's participation and bottom-up approach of watershed management; conservation education and extension; coordination, legal approaches and the current efforts and policy of soil conservation and watershed management in Nepal.

SSC 703 Soil Fertility and Plant Nutrition (2+1)

Soil fertility past and present - a historical perspective; essential elements - occurrence, chemistry and availability; role of essential elements in plant nutrition; nutritional disorders and toxicities in plants; a brief resume of non-essential elements; source and methods of preparation of different types of compost; roles of manure in soil fertility and plant nutrition; characteristics and behavior of nitrogenous, phosphoric, potassic and zinc fertilizers in soils; fertilizer need assessment; soil fertility evaluation methods; use of nitrification inhibitors and slow release fertilizers; soil-test-crop response correlation; mechanisms of nutrient losses from soil and their control measures.
Methods of analysis for macronutrients in soils and plants; study of nutrient deficiency symptoms in pot experiments; tissue tests for N, P, and K.

SSC 704 Soil Classification and Mapping (1+1)

Soil morphology; parent materials; landforms, relief, and drainage; geo-chemical and pedo-chemical weathering; criteria and nomenclature for USDA system of soil classification and its comparison with FAO/UNESCO system; setting and profile processes of soils at order and sub-order levels; characters and purpose of soil maps and reports; tools and sources of data acquisition in soil survey; method of preparation and uses of soil survey reports. Kinds of soil survey; determination of map scale and map units; plan for field work; procedure of soil survey and mapping; selection of profile inspection sites; examination and description of soils in the field; laboratory analysis of soil samples; map preparation; conducting a soil fertility survey on farmers' fields around IAAS farm and presentation of report by individual students.

SSC 705 Chemistry of Soil Fertility (2+0)

Sources, distributions, forms and transformations of macro and micronutrients in soils; nutrient interaction and absorption by plants; nutrient absorption, mechanisms by plant roots and nutrient transport in soil solid and liquid phase; ion activity and ionic equilibria in soils; cation and anion exchange phenomena in soils; fixation and release of nutrients in soil; relationship of Q/I in plant nutrient uptake; characteristics and management of acidic, saline and sodic soils on nutrient availability and plant growth; nutrient availability and crop selection for problem soils; role of chelation and coating in the availability of plant nutrients; importance of isotopes in soils and plant research.

SSC 706 Soil Microbiology (2+0)

History of soil microbiology; soil as a biological habitat; soil ecology; distribution and types of soil organisms- bacteria, actinomycetes, fungi, algae, viruses, protozoa and earthworms; significance of soil organisms in soil formation, aggregation and soil fertility; biological equilibrium in soils; soil organic matter and its decomposition by soil organisms and humus formation; biological transformation of C, N, and S in soils; concept of soil rhizosphere and phyllosphare; associative activities of micro organisms in soils atmospheric N-fixation by symbiosis and asymbiosis, ecto and endomycorrhizal plant association and their significance; microbial inoculants and biofertilizers.

SSC 707 Soil, Water and Plant Analysis (0+1)

Importance of soil, water and plant analysis; principles of volumetric, gravimetric and colorimetric analysis; analysis of soils, plants, fertilizers, manure and irrigation water for N, P, and K; water analysis for Ca, Mg, Na and electrical conductivity; ashing and digestion of plant materials by wet and dry method and determination of nutrients in digest by atomic absorption; and interpretation of analytical data obtained from soil, plant and water samples in relation to soil fertility.

SSC 708 Chemistry of Soil Organic Matter (2+1)

Soil organic matter - source, nature, composition and importance in agriculture; stages of development of soil organic matter; present days ideas regarding chemical nature, formation and important physico-chemical properties of clay-humus complex; effects of soil organic matter on soil formation and soil productivity; humus synthesis, organometallic interactions, and clay-humus complexes; complexing of metals by soil organic matter and natural chelates in soils; role of chelating agents in the availability of nutrients to the plants; and mechanisms of interactions of humic substance with metal cations, and release of nutrients for plant nutrition. Determination of organic matter; separation and fractionation of soil organic matter; determination of CEC and elemental composition of humic acid and fulvic acid.

SSC 709 Micronutrients in Soils and Plants (2+1)

Micronutrients - geochemistry, distribution in soil profile, functions, deficiency and toxicity symptoms in plants, and their chemistry; micronutrients forms and factors affecting their availability; interactions of micronutrients and other nutrients in soil and plant systems; concept of micronutrient uptake by plants and methods of overcoming micronutrient deficiency; residual effects of micronutrients; micronutrients containing fertilizers and their transformation in soils; micronutrient solubility and chelation reaction; influence of pH and Eh on micronutrient availability; and importance of micronutrients in Nepalese agriculture. Determination of available micronutrients in soils and plants through conventional and absorption spectrophotometric methods.

SSC 710 Chemistry of Submerged Soils (2+1)

Difference between upland and waterlogged soils; effects of submergence on chemical, physical and biological properties of waterlogged soils; oxygen diffusion model and behavior of N,P,S and micronutrients in waterlogged soils; development, characteristics and management of waterlogged soils; electrochemical changes, mineral equilibria, ion exchange and chemical kinetics of lowland paddy soils; and decomposition of organic matter under submerged soil condition and availability of nutrients.
Redox potential measurement; EC and pH determination at different regime of soil moisture; determination of available P, N, and S of submerged soils.

SSC 711 Soil Test and Crop Response (2+1)

Soil testing - objectives, scope, importance, and uses; historical background and development of soil testing in Nepal; soil sampling, soil test methodology screening, soil

test summaries and preparation of regional soil fertility maps; organization and operation of soil testing laboratories and soil testing equipments; growth equations; soil sampling plan; correlation and calibration of soil test values in relation to crop response; A - value technique; soil test for micronutrient; and concepts of maximum yield, optimum yield and targeted yield. Soil sampling of the area; determination of textural groups and preparation of soil fertility map; and soil test values by different techniques and their correlation.

SSC 712 Land Use Planning and Management (1+1)

Principles and methods of land assessment: evaluation of methodology, soil information system, parametric methods, and the land system method; and review and appraisal of land characteristics based on available land information on topography, geology, climate, soil, hydrology and socio-economy of the area. Field study for inventory of land resources for various utilization; and assessment of land utilization and preparation of land suitability recommendation; report useful for planning of land resources.

SSC 713 Pollution of Soil Environment (2+0)

A review of the impact of human and industrial activity, waste disposal, sewage sludge, etc. on soil environment; environmental aspect of soil fertility in consideration of soils for accepting essential plant nutrients and potentially toxic non-essential elements; use of N-regulators and non-conventional soil additives as fertilizers; soil in the ecosystem; chemical pesticides and soil environment; bio-degradation of pesticides; and irrigation residues and water quality problems.

SSC 714 Remote Sensing and GIS in Soil and Agriculture 2 (1+1)

Concepts, definition, principles, and implications of RS and GI; EMR, Remote sensors, and physical basis of signature; Hardware and Software requirement of GIS; Conceptual and data models; digitizing and editing data maps; application of RS and GIS in agriculture.

11. ANIMAL BREEDING

Departmental Courses		Credit Hrs.
ANB 701	Animal Research Methodology	3+0
ANB 705	Advanced Ruminant Breeding	2+1
ANB 706	Biotechnological Animal Breeding	3+0
ANB 707	Advanced Poultry Breeding	3+0
ANB 711	Animal Production Physiology	2+1
ANB 718	Animal Endocrinology	3+0
ANB 726	Reproductive Physiology	2+1
ANB 727	Rare Breed of Animal, their Conservation and Utilization	3+0
ANB 790	Special Problem	0+2
ANB 799	M.Sc. Seminar	0+2
ANB 800	M.Sc. Thesis	0+6
ANB 899	Ph.D. Seminar	0+2
ANB 900	Ph.D. Dissertation	0+15

ANB 701 Animal Research Methodology (3+0)

Review of different experimental designs CRD, RCBD, factorial, Latin Square; randomization of experimental units (animals); covariance and blocking approaches for homogenization of experimental units; CRD in animal science experiments; factorial split design in fodder and nutritional experiments; Latin Square Design in nutritional and relevant studies; nested design in estimating the genetic parameters; CRD, RCBD, and factorial designs in aquaculture; principle of regression; least square and modeling techniques.

ANB 705 Advanced Ruminant Breeding (2+1)

Applied breeding techniques of cattle, buffalo, sheep, goat and poultry; evaluation of genetic worth of sire and dam; genetic improvement of economic tract of animals; evolving a new breed; preparation of breeding plans; evaluation of genetic worth of cows; selection of dairy heifers; estimation of breeding values of cows (MPPA, EATA, VB, PBV); sire evaluation; dam bull selection; progeny testing; herd comparison; contemporary comparison; predicted difference; sire summaries and limitations; breeding and selection for reproduction and production efficiencies including biotechnological approaches; evolving new breed of cattle and buffalo; improvement techniques in sheep and goat; milk production strategy through cattle and buffalo; improvement strategy for production of meat, wool, and fiber in sheep and goat; principle of selection index; preparation of a breeding plan.

ANB 706 Biotechnological Animal Breeding (3+0)

Modern molecular breeding approaches; possible ways of genetic improvement such as through ET and nuclear transplantation; uses of molecular techniques for identification of genetic phenomena at DNA level; review of genetic properties; ovarian dynamism and uses of ova in animal biotechnology; recent advances in artificial insemination; embryo transfer technology and its contribution in genetic improvement; role of embryo bisection

and nuclear transplantation; genetic improvement; DNA cloning; gene transformation; manipulation of genetic constitution; transgenic animal production and its role in genetic improvement; DNA polymorphism; tagging of genes; protein polymorphism; determination of genetic distances; monoclonal antibody production (hybridoma technique); genetic principles of disease resistance and gene therapy; animal biotechnology activities in Nepal; and genetic progress achieved through biotechnology in animal species aboard.

ANB 707 Advanced Poultry Breeding (3+0)

Inheritance of morphological, economic, polymorphic, threshold, and sex linked traits, and their utility in genetic improvement of poultry; formation, maintenance, and utility of control populations; efficiency of different intrapopulation selection schemes; interpopulation selection to utilize additive and non-additive genetic effects; development and use of inbred lines and their maintenance; formation and stabilization of synthetic populations; breeding poultry for egg and meat production; use of molecular genetics and biochemical polymorphism in poultry breeding; genetic engineering and transgenes in poultry breed formation; breeding poultry for disease and parasite resistance.

ANB 711 Animal Production Physiology (2+1)

Organization and ultrastructure of mammary gland; hormonal requirements for mammary growth and development; lactogenesis; regulation of established mammary functions; milk precursors; biosynthesis of milk components; factors affecting yield and composition of milk; mammary regression; induction of lactation; species variations in mammary gland functions; bovine growth hormones and lactational performance; concept and definition of growth theories; measures of pre and post natal growth; growth regulation; patterns of growth and development of bone muscle and fatty tissues; growth and thermal environment; nutritional inputs for growth-energy, protein, minerals, and vitamins; energy efficiency of growth; hormonal requirements for growth and mechanism of their actions; and growth in relation to meat production and quality in mammals and birds.

ANB 718 Animal Endocrinology (3+0)

Chemical messengers; general nature, functions and regulation of hormones and anti-hormones; pituitary gland, its hormones, its functions and their regulation (adrenocorticotropic hormone (ACTH), thyroid stimulating hormone, and growth hormone), parathyroid gland, and its hormonal regulation; structure of pineal gland, hormones, functions and regulation, pancreas, insulin and glycogen, functions; sex steroids-sources, function and regulation; placental gonadotropins sources and functions; postaglandins-sources and functions; gastrointestinal hormones - sites of secretion, function and regulation; hormones of pregnancy, parturition and lactation; endocrinology of ovary and testis.

ANB 726 Reproductive Physiology (2+1)

Differentiation of reproductive systems; origin of germ cells, duct system, and external genitalia of male and female reproductive systems; endocrinology of reproduction; pituitary gland; breeding season; gonadotropic complex in non-oestrous states;

classification of gonadotrophin; hypothalamus and pituitary relationship; reproductive physiology of hen; ovarian follicles, ovulation, and corpora lutea; hormonal regulation during oestrous, pregnancy, parturition, lactation, and dry periods; reproduction in males; testes; androgens; hormonal control of testes, germ cells, and young embryo; efficiency of reproduction; pregnancy; parturition; lactation; fertility and sterility; anatomical defects in females and males; endocrine causes of sterility; degree of fertility; impaired fertility; attempts to improve fertility.

ANB 727 Rare Breeds of Animals, their Conservation and Utilization (3+0)

Rare breeds of different species of animals: characteristics, economic merits, importance, for genetic manipulation and sustainable agriculture, reasons for being endangered, strategies for conservation, successful cases/models of conservation around world, prerequisites for conservation, genome sequencing and banking, gene isolation using markers, and use of cloned genes in improving productivity of the modern breeds.

ANB 790 Special Problem (0+2)

Laboratory and field works or survey or case studies on the issues identified by the Advisory Committee.

12. ANIMAL NUTRITION AND FODDER PRODUCTION

Departmental Courses		Credit Hrs.
ANU 702	Applied Animal Nutrition	2+1
ANU 708	Feedstuff Analysis and Quality Control	2+1
ANU 709	Ruminant Nutrition	2+1
ANU 710	Non-ruminant Nutrition	2+1
ANU 712	Basic of Agriculture System	2+0
ANU 713	Case Study of Livestock Production Systems of Nepal	0+1
ANU 717	Fodder Production and Pasture Management	2+0
ANU 729	Range Lands and Pastoral Development	3+0
ANU 790	Special Problem	0+2
ANU 799	M.Sc. Seminar	0+2
ANU 800	M.Sc. Thesis	0+6
ANU 899	Ph.D. Seminar	0+2
ANU 900	Ph.D. Dissertation	0+15

ANU 702 Applied Animal Nutrition (2+1)

Applied nutrition covering requirements of cattle, buffaloes, sheep and goats; nature and uses of various feedstuffs for ruminants rations with practices in feed formulation, identification and techniques in nutrition research; economic importance of applied nutrition in livestock production; basic terminology in ruminant nutrition studies; role of the ruminant nutritionist; nutritional constraints to livestock production in Nepal; general nutritional considerations; review of essential and non-essential nutrients, and their functional roles and biochemical functions in the animal body; composition of plant tissue and byproducts; composition of the body of ruminant animals; digestive systems and processes in different animal species; cellular metabolism; carbohydrate metabolism; pathways for energy extraction and synthesis; metabolism of fats and lipids; fat catabolism in ruminants; mineral and vitamin metabolism; metabolic functions; mode of action of antibiotics, hormones, and growth, factors; growth responses in ruminants; energy concepts; forms of energy; models for energy metabolism; energy distribution in body processes; measures of food energy, physiological fuel values, respiration calorimetry, and body temperature; nutritional value of feedstuffs for ruminants; classification of feedstuffs; methods of feed evaluation; physical, chemical, biological, *in-vitro*, and *in-vivo* methods; feed trials; energy and nitrogen balances; evaluation of energy and protein values; quantitative nutrient requirements of ruminants; maintenance requirement; requirements for growth, reproduction, pregnancy, lactation, and work; design and formulation of ruminant rations; use of current feeding standards; balancing rations (practical and experimental)for different ruminants species; improving economic efficiency of ruminant feeds; researchable problems and research programs in ruminant nutrition; identification of constraints to higher production; and suitable research programs and developmental strategies for ruminant feeding.

ANU 708 Feedstuff Analysis and Quality Control (2+1)

Introduction, importance, scope, methods, advantages and disadvantages of feedstuff analysis; characteristics of feedstuffs; nutrient composition and antinutritional factors; feed

additives, supplements, and adulterants, and their characteristics; factors affecting quality of feed ingredients and mixed feeds; specification of feed ingredients and their nutrient composition; identification of feed ingredients, feed supplements and additives; evaluation of feed quality; preparation of standard solution; proximate and NDF, ADF, Ca, P determinations; determination of adulterants in feed ingredients, mixed feed, feed supplements, and additives.

ANU 709 Ruminant Nutrition (2+1)

Nutritional and physiological behavior of ruminants; input output relationship in lactating animals; methods of digestibility determination; factors affecting nutrient digestibility; energy concepts; determination and use of non-conventional feedstuffs; preparation, formulation and mixing of concentrate mixtures for various productive purposes; and preparation of feed additives.

ANU 710 Non-ruminant Nutrition (2+1)

History and advances of non-ruminant nutrition; distinct features of non-ruminant nutrition; conventional and non-conventional feedstuffs and feed additives for poultry and swine; nutrient composition and requirements; feed formulation and feeding; nutritional deficiency and disorders and their prevention; efficiency of feed utilization by non-ruminants; identification of feed ingredients and feed additives; formulation and compounding of diets for broilers, layers, and swine; preparation of promix; and feeding practices.

ANU 712 (or AGR 712) Basic of Agricultural Systems (2+0)

System approach to agriculture, definition and scope; subsidy and sustainability of agricultural systems with examples; purpose and properties of agriculture systems; approaches to understanding agricultural systems; global environmental changes; principles and procedures of agroecosystem analysis; understanding crop-livestock integration; and social system and institutional support.

ANU 713 Case Studies (Livestock Production Systems: Pilot Project) (0+1)

There are many cases of livestock production and management systems in the Nepalese context with the increasing efforts of developing the animal sector. Several interesting complexities are found in animal production systems across the hierarchy from small scale to the commercial farmers in a system perspective as villages, communities, regional, national, and international levels which have distinct relationships with the plans and policies of the government. Students on the course will focus on project work as outlined here: a) action plan: identification of specific competency area, introduction- motivation, vision, relation to professional context; objective- the skill and knowledge that the learner wish to develop; process/design; resources, activities with the corresponding schedule; b) field works; c) document writing; d) getting feedback- consultant feedback and feedback; peer review and feedback; e) document submission; and f) evaluation.

ANU 717 Fodder Production and Pasture Management (2+0)

Classification of grasses and their nutritive value; cultivation practices of important seasonal grasses, their utilization, and conservation; organizing pasture research with respect to real field situation; soil fertility management; agronomy of improved pastures; pasture establishment and management; and production of forage legume seeds.

ANU 729 Rangeland and Pastoral Development (3+0)

Introduction to rangelands and pastoral developments. Relation of animal husbandry and pasture development; status of rangelands and rangeland development in Nepal; tropical and hill pastures and their nutritional characteristics; factors affecting the natural grassland; sustainable rangeland management; small ruminants production and pastoral development; pastoral development its relevance to large ruminants; problems in pasture/fodder development; methods of pasture and fodder development; government policy as program for pasture development in Nepal; role of NGO's and INGO's and NARC in the pasture development; new perspectives on range management and pasturalism and their implications for HKH-Tibetan plateau rangelands, conservation of biological diversity in the HKH-Tibetan plateau rangelands; forage and fodder development on the range land of the Himalayas; forage and fodder seed production for pasture development, strategies to manage the range deterioration in Nepal; pasture and fodder species suitable to different agro-climatic environment; package and practices to important grasses and legumes suitable to different to different agro-climatic environment, characteristics of rangeland ecosystem in northern region of Nepal; potentials and constraints of range land ecosystem.

ANU 790 Special Problem (0+2)

Laboratory and field works or survey or case studies on the issues identified by the Advisory Committee.

13. LIVESTOCK PRODUCTION AND MANAGEMENT

Departmental Courses		Credit Hrs.
LPM 703	Advanced Ruminant Management	2+1
LPM 704	Advanced Pig and Poultry Management	2+1
LPM 719	Market Milk and Quality Control	2+1
LPM 720	Commercial Dairy Farming	1+1
LPM 721	Animal Product Technology	2+1
LPM 722	Dairy Cattle Housing and Hygiene	1+1
LPM 723	Poultry Production Technology and Quality Control	2+1
LPM 724	Drought Animal Production	2+1
LPM 725	Domestic Animal Diseases	3+0
LPM 790	Special Problem	0+2
LPM 799	M.Sc. Seminar	0+2
LPM 800	M.Sc. Thesis	0+6
LPM 899	Ph.D. Seminar	0+2
LPM 900	Ph.D. Dissertation	0+15

LPM 703 Advanced Ruminant Management (2+1)

Care and management of dry, lactating, and pregnant dairy animals; draft animal training for AI; raising young calves and heifers; maintenance of high fertility level in the herb; breeding records; selection and culling of dairy cows and breeding bulls; regulating feeding management of dairy herd; computing practical and economic rations for different categories; care and management of *yak nak chouri* and mule; estimation and supply of feeds and fodder; economics of a dairy enterprise; housing management; management of sheep and goat on range and under stall fed condition; sheep and goat husbandry practices in Nepal; review of work on lamb and kid production and performance; setting up sheep and goat farms; economics of sheep and goat production; and utilization and improvement of pastureland.

LPM 704 Advanced Pig and Poultry Management (2+1)

Present status of poultry enterprise management; problems of chicks; growing, laying and breeding flocks; care and management of broilers; incubation, brooding, rearing, housing and feeding of chicken, turkey and ducks; culling and selection of laying flocks; cage vs floor system; litter, light and ventilation for poultry; incubator and its operation; selection of eggs for hatching, transportation, marketing and distribution; sexing chicks; hatchery management and waste utilization; equipments for poultry farming; problems of swine husbandry in Nepal; prominent swine breeds in Nepal; management of weaning piglets, gilt, sow and boar; selection of breeding sow and boar; housing system and equipments; latest feeding techniques; intensive system of swine management; recent advances in swine production; and economics of swine production.

LPM 719 Market Milk and Quality Control (2+1)

Market milk industry in advanced countries; statistics of production and utilization of milk abroad and in Nepal; set up of a dairy plant, and the losses, processing cost and factors

affecting it; disposal of dairy affluent; definition of equality milk; standards of chemical quality of milk and milk products; legal standard; different tests for determining quality; laboratory control of milk processing and milk products; selection, grading principles, and importance of milk legislation and food adulteration.

LPM 720 Commercial Dairy Farming (1+1)

Dairy farming status in Nepal; dairy farming as mixed and as specialized farming; economic dairy farming; starting a dairy farm; capital and land requirement; procurement of dairy stock; factors determining of the efficiency of dairy animals; herd recording; budgeting; cost of milk production; pricing policy; and milk disposal, storage and distribution.

LPM 721 Animal Product Technology (2+1)

Composition, physico chemical and nutritional properties of meat, milk and their products. Microbiology of meat and milk, methods of analysis and quality control, microbiological in processing changes occurring in ripening, cutting, smoking and other manufacturing process. Different delicacies of meat and milk. Use of by products methods of reducing contamination. Preservations of milk, meat and their products. Organoleptic examination of meat and milk. Preparation of meat roils, sausages, pickles etc *khoa,* icecream, yoghurt*, chhenna*, butter, cheese etc.

LPM 722 Dairy Cattle Housing and Hygiene (1+1)

Environmental effect on dairy animals (direct and indirect); adaptability to different types of housing systems; types of dairy animal housing systems; selection of site and laying out of dairy farm; water requirement, air, ventilation and light; sanitation and waste disposal; control major for diseases and parasites on dairy farms; use of local resources for dairy animal houses; cost of construction and maintenance of farm building; and different processes used for amelioration of summer and winter stress.

LPM 723 Poultry Production Technology and Quality Control (2+1)

Factors affecting on the mode of laying, and structure and component of eggs; factors affecting egg composition, preservation, nutritional value and industrial uses; nutritional value of chicken; inedible poultry products and their uses; delicacies of egg and chicken; sources of bacterial contamination of meat; bacteriological examination of meat and the methods of reducing contamination; food poisoning; decomposition of meat and fat; preservation of meat by drying, salting, picking, freezing and canning; and organoleptic test of meat and eggs.

LPM 724 Draught Animal Production (2+1)

Origin and use of working animals; prospects, potential and importance of draught animal in contest of the farming system of Nepal; socio-economic contribution of draught power by working animal in different region of Nepal; bullock, buffalo and mules as drought animals and their characteristics; draught animal selection and training; environmental and physiological factors related to draught output; management, health, nutrition, and feeding

technologies for draught animals; draught animal harness and effect on draught output; measuring draught load and output of working animals; housing of draught animal; dehorning, castration, hoof trimming and control of ecto-parasites of draught animal; disease and parasites of draught animals, and their prevention and control measures; vaccination use for draught animals; and impact of diseases and parasites on the draught output of working animals.

LPM 725 Domestic Animal Diseases (3+0)

General epidemiology of infectious disease; principles of prevention and control of diseases; detailed studies on common bacterial diseases (Haemorrhagic Septicaemia, Black quarter, Tetanus, Anthrax, Brucellosis, Mastitis, Johne's disease, Contagious bovine pleuropheumonia, Contagious caprine pleuropheumonia, Strangle, Glander, Swine erysepalas, Enterotoxaemia); viral diseases (Rinderpest, foot and moutn disease, rabies, infectious equine anaemia, pestes de petit ruminant, hog cholera, canine distemper, canine parvovirus infection); fungal diseases (ringworm); protozoan diseases (Theileriasis, Babesiasis, Trypanosomiasis) and detailed accounts on emerging infectious disease of poultry such as Pullorum; complicated chronic respiratory disease; infectious bursal disease; infectious bronchitis; Newcastle disease; egg drop syndrome-76, Marek's disease etc.

LPM 790 Special Problem (0+2)

Laboratory and field works or survey or case studies on the issues identified by the Advisory Committee.

14. ANIMAL SCIENCE WITH SYSTEM LEARNING APPROACH (SLA)

Department Courses		Credit Hrs.
A. Courses from Major and Other Relevant Departments		
EXT 790	Special Problem: SLA based on workshop/discussion	0+2
ANU 712	Basics of Agricultural Systems	2+0
ANU 713	Case Studies (Livestock Production Systems: Pilot Project)	0+1
EXT 706	Group Dynamics and Leadership	2+0
EXT 708	Development Communication	2+0
AEC 715	Economics of Agricultural Marketing (With emphasis on Livestock Marketing)	3+0
ANU 799	M. Sc. Seminars(two)	0+2
ANU 800	M. Sc. Thesis (Action Research on SLA Related Problems)	0+6
B. Basic Courses		
ENG 701	Technical Writing English	2+0
AST 711	Statistical Methods in Biological Sciences	2+1
BCH 728	General Biochemistry	2+1
C. Courses from Major Department		
A minimum of 12 credit hours courses form major department must be enrolled.		
ANU 799	M. Sc. Seminars	0+2
ANU 800	M. Sc. Thesis	0+6

A. Courses from Major and Other Relevant Departments

EXT 790 Special Problem: SLA based on workshop/discussion (0+2)

System learning, learning approach to change, ways and levels of learning, experiential learning, action learning, reflection, essence of wholeness, systemic improvement in problematic situation, world views and developmental paradigm, self development, community development and organizational development, course members' interest issues etc".

ANU 712 (or AGR 712) Basics of Agricultural Systems (2+0)

System approach to agriculture, its definition and scope; subsidy and sustainability of agricultural systems with examples; purpose and properties of agriculture systems; approaches to understanding agricultural systems; global environmental changes; principles and procedures of agroecosystem analysis; understanding crop-livestock integration; and social system and institutional support.

ANU 713 Case Studies (Livestock Production Systems: Pilot Project) (0+1)

There are many cases of livestock production and management in the Nepalese context with the increasing efforts of developing the animal sector. Several interesting complexities are found in animal production systems across the hierarchy from small scale to the commercial farmers in a system perspective at villages, communities, regional,

national, and international levels which have distinct relationships with the plans and policies of the government. Student in this course will focus on project work as outline below:

(a) Action Plan
- Identification of specific competency area
- Introduction – motivation, vision, relation to professional context
- Objective – the skill and knowledge that the learner wish to develop
- Process/design
- Resources
- Activities with the corresponding time schedule

(b) Field works
(c) Document writing
(d) Getting feedback
- Consultant review and getting feedback
- Peer review and getting feedback

(e) Document submission
(f) Evaluation

EXT 706 Group Dynamics and Leadership (2+0)

An overview of group dynamics as a discipline and its development, some theories, principles and applications from the allied sciences in attitude, behavior, rooms conformity and compliance, consistency and cognitive aspects of human beings. Group development processes and stages, group strutting and interaction process, group process and techniques used in problem solving and decision making, group leadership, power and influence leadership styles, typology, leader behavior- theories, approaches and leader effectiveness. Conflict management sources and resolution techniques.

EXT 708 Development Communication (2+0)

Definition, meaning, scope and type of communication, sociological, psychological and cultural perspectives of communication, communication strategies in agricultural development, past and present with large and small community, groups and individuals, action and functional models in agricultural development programs, roles of cooperation, conflict, consensus and congutency, role of public and private organizations in developmental programs, communication systems and their interrelationship and impact on rural development, current communication strategies in agricultural development of Nepal, communication policies linked with national and international agencies, and communication media and society at present and future.

AEC 715 Economics of Agricultural Marketing (3+0)
(With emphasis on Livestock Marketing)

Marketing and market structures; agricultural marketing systems; transportation issues and location theory; consumers' choice and demand; temporal and spatial dimension of price and product distribution; complete demand models; analysis of technical and pricing efficiency of agricultural markets; examination of issues relating to agricultural markets and marketing; critical evaluation of theoretical and empirical procedures for estimating supply and demand relations; production functions; mathematical programming; growth

models of firms and simulation; development of agricultural market; critical review of the roles of various agencies involved in the marketing of agricultural products and formulating of policies in Nepal.

B. Basic Courses

ENG 701 Technical Writing English (2+0)

Use of noun, pronoun, verbs, adverbs, adjectives, tenses, active/passive; Review, English Science, Paragraph and punctuation; Note taking, Information collection, presentation, using tables and figures; Reference citation, Assignment writing.

AST 711 Statistical Methods in Biological Science (2+1)

Review of previous statistical course; descriptive and inferential statistics; probability distribution and sampling distribution; least squares and maximum likelihood methods of estimation; tests of hypothesis (F, t and $\chi 2$); correlation and regression (simple and multiple); regression modeling and checking for assumptions; analysis of count of score data; non-parametric methods; introduction to some multivariate methods; design of experiments; CRD, RBD, LSD and split-plot design; considerations to treatment structure and quantitative treatments; analysis of covariance; combined analysis of multi-site and/or multiyear data; stability regression (for plant sciences) and meta-analysis (for animal sciences); analysis of repeated measurements; experiments in farmers' fields; and problem data.

BCH 728 General Biochemistry (2+1)

Introduction, cell organelles – structure and functions; Aqueous medium of the protoplasm, physical properties, biological importance, pH, Henderson- Hassellbalch equation, physiological buffer system; Amino acids and peptides – general properties, structural features, protonic equilibria and ionic structures, the peptide bond, peptides and polypeptides; protein – solubility classification, structure and function of a protein hemoglobin; enzyme- catalysis, nature of enzymes, specificity, active site and substrate binding enzyme; Hormones – classification and properties, kinetics; bioenergitics – free energy concept, standard energy changes; carbohydrate metabolism; lipids, phospholipids and steroids, bilayer lipid membrane; nucleotide, nucleic acids; protein metabolism; Polarity and non-polarity of biological substances, quantitative estimation and biochemical assay through spectrophotometer, chromatography and electrophoresis; preparation of buffer solutions, detection and quantification; carbohydrates, lipids, proteins and nucleic acids isolation, purification of enzymes, assay of important enzymes, characterization of different biochemical substances through spectrophotometry; Separation and quantification through chromatograph; Electrophoresis for protein and nucleic acid separation.

C. Courses from Major Departments

A student must enroll a minimum of 12 credit hours from the major departments (Animal Nutrition and Fodder Production, Livestock Production and Management, and Animal Breeding and Biotechnology).

15. ANIMAL SCIENCE (LIVESTOCK EXTENSION)

Department Courses		Credit Hrs
A. Courses from major and other relevant departments		
EXT 701	Extension Education	2+0
EXT 708	Development Communication	2+0
EXT 711	Program Planning in Agricultural Extension	2+0
EXT 712	Monitoring and Evaluation of Agricultural Extension Program	2+0
AEC 715	Economics of Agricultural Marketing (with emphasis on Livestock Marketing)	3+0
LPM 703	Advanced Ruminant Management	2+1
LPM 719	Market Milk and Quality Control	2+1
ANU 702	Applied Animal Nutrition	2+1
ANU 712	Basics of Agricultural Systems	2+0
ANU 713	Case Studies (Livestock Production Systems of Nepal)	0+1
ANU 790	Special Problem: Based on workshop/discussion	0+2
ANU 799	M. Sc. Seminars(two)	0+2
ANU 800	M. Sc. Thesis	0+6
B. Basic Courses		
ENG 701	Technical Writing English	2+0
AST 711	Statistical Methods in Biological Sciences	2+1
BCH 728	General Biochemistry	2+1
C. Courses from major department		
A minimum of 12 credit hours courses form major department must be enrolled.		
ANU 799	M. Sc. Seminars	0+2
ANU 800	M. Sc. Thesis	0+6

A. Courses from Major and Other Relevant Departments

EXT 701 Extension Education (2+0)

Why extension system is necessary? Origin and growth of extension education in historical perspective. Extension education as a professional and as a discipline. Concept, scope, principles, processes, philosophy and objectives of extension education. Need for extension training, extension education and community development. Teaching and learning in extension education. Extension teaching methods. Extension strategies for technology utilization and minimizing risk. Gender issues in extension education. Role of Agricultural College/University.

EXT 708 Development Communication (2+0)

Definition, meaning, scope and type of communication, sociological, psychological and cultural perspectives of communication, communication strategies in agricultural development, past and present with large and small community, groups and individuals, action and functional models in agricultural development programs, roles of cooperation, conflict, consensus and congutency, role of public and private organizations in

developmental programs, communication systems and their interrelationship and impact on rural development, current communication strategies in agricultural development of Nepal, communication policies linked with national and international agencies, and communication media and society at present and future.

EXT 711 Program Planning in Agricultural Extension (2+0)

Philosophy and philosophical framework of program planning, concepts and approaches, analysis and review of programming models, planning gains, roles and responsibilities of planners, levels of plan and relationship between various levels, planning methodology, cycle and stages, rural development and extension program planning, people's participation, organizational consideration, situation analysis, need analysis methodology, individual level, community level, priority setting, objectives and levels of objectives, network analysis, networking, PERT, CPM, participatory monitoring and evaluation.

EXT 712 Monitoring and Evaluation of Agricultural Extension Programs (2+0)

Introduction, concept of evaluation and monitoring, principles and functions of evaluation, monitoring and evaluation, evaluation and extension, evaluation and research, evaluation and measurement, types of evaluation, role of objectives in program evaluation, basic terminology, levels and types, taxonomy of educational objectives, criteria for selecting appropriate objectives, methods of stating objectives, techniques and procedure of quantitative and qualitative evaluation, different techniques and procedures, concept and process used in CIPP model, and comparative analysis of other extension program planning evaluation models.

ANU 790 Special Problem (0+2)

Laboratory and field works or survey or case studies on the issues identified by the Advisory Committee.

AEC 715 Economics of Agricultural Marketing (With emphasis on Livestock Marketing) (3+0)

Marketing and market structures; agricultural marketing systems; transportation issues and location theory; consumers' choice and demand; temporal and spatial dimension of price and product distribution; complete demand models; analysis of technical and pricing efficiency of agricultural markets; examination of issues relating to agricultural markets and marketing; critical evaluation of theoretical and empirical procedures for estimating supply and demand relations; production functions; mathematical programming; growth models of firms and simulation; development of agricultural market; critical review of the roles of various agencies involved in the marketing of agricultural products and formulating of policies in Nepal.

LPM 703 Advanced Ruminant Management (2+1)

Care and management of dry, lactating, and pregnant dairy animals; draft animal training for AI; raising young calves and heifers; maintenance of high fertility level in the herb;

breeding records; selection and culling of dairy cows and breeding bulls; regulating feeding management of dairy herd; computing practical and economic rations for different categories; care and management of *yak nak chouri* and mule; estimation and supply of feeds and fodder; economics of a dairy enterprise; housing management; management of sheep and goat on range and under stall fed condition; sheep and goat husbandry practices in Nepal; review of work on lamb and kid production and performance; setting up sheep and goat farms; economics of sheep and goat production; and utilization and improvement of pastureland.

LPM 719 Market Milk and Quality Control (2+1)

Market milk industry in advanced countries; statistics of production and utilization of milk abroad and in Nepal; set up of a dairy plant, and the losses, processing cost and factors affecting it; disposal of dairy affluent; definition of equality milk; standards of chemical quality of milk and milk products; legal standard; different tests for determining quality; laboratory control of milk processing and milk products; selection, grading principles, and importance of milk legislation and food adulteration.

ANU 702 Applied Animal Nutrition (2+1)

Applied nutrition covering requirements of cattle, buffaloes, sheep and goats; nature and uses of various feedstuffs for ruminants rations with practices in feed formulation, identification and techniques in nutrition research; economic importance of applied nutrition in livestock production; basic terminology in ruminant nutrition studies; role of the ruminant nutritionist; nutritional constraints to livestock production in Nepal; general nutritional considerations; review of essential and non-essential nutrients, and their functional roles and biochemical functions in the animal body; composition of plant tissue and byproducts; composition of the body of ruminant animals; digestive systems and processes in different animal species; cellular metabolism; carbohydrate metabolism; pathways for energy extraction and synthesis; metabolism of fats and lipids; fat catabolism in ruminants; mineral and vitamin metabolism; metabolic functions; mode of action of antibiotics, hormones, and growth, factors; growth responses in ruminants; energy concepts; forms of energy; models for energy metabolism; energy distribution in body processes; measures of food energy, physiological fuel values, respiration calorimetry, and body temperature; nutritional value of feedstuffs for ruminants; classification of feedstuffs; methods of feed evaluation; physical, chemical, biological, *in-vitro*, and *in-vivo* methods; feed trials; energy and nitrogen balances; evaluation of energy and protein values; quantitative nutrient requirements of ruminants; maintenance requirement; requirements for growth, reproduction, pregnancy, lactation, and work; design and formulation of ruminant rations; use of current feeding standards; balancing rations (practical and experimental)for different ruminants species; improving economic efficiency of ruminant feeds; researchable problems and research programs in ruminant nutrition; identification of constraints to higher production; and suitable research programs and developmental strategies for ruminant feeding.

ANU 712 (or AGR 712) Basics of Agricultural Systems (2+0)

System approach to agriculture, its definition and scope; subsidy and sustainability of agricultural systems with examples; purpose and properties of agriculture systems;

approaches to understanding agricultural systems; global environmental changes; principles and procedures of agroecosystem analysis; understanding crop-livestock integration; and social system and institutional support.

ANU 713 Case Studies on Livestock Production Systems of Nepal (0+1)

There are many cases of livestock production and management in the Nepalese context with the increasing efforts of developing the animal sector. Several interesting complexities are found in animal production systems across the hierarchy from small scale to the commercial farmers in a system perspective at villages, communities, regional, national, and international levels which have distinct relationships with the plans and policies of the government. Student in this course will focus on project work as outline below:

(a) Action Plan
- Identification of specific competency area
- Introduction – motivation, vision, relation to professional context
- Objective – the skill and knowledge that the learner wish to develop
- Process/design
- Resources
- Activities with the corresponding time schedule

(b) Field works
(c) Document writing
(d) Getting feedback
- Consultant review and getting feedback
- Peer review and getting feedback

(e) Document submission
(f) Evaluation

B. Basic Courses

ENG 701 Technical Writing English (2+0)

Use of noun, pronoun, verbs, adverbs, adjectives, tenses, active/passive; Review, English Science, Paragraph and punctuation; Note taking, Information collection, presentation, using tables and figures; Reference citation, Assignment writing.

AST 711 Statistical Methods in Biological Science (2+1)

Review of previous statistical course; descriptive and inferential statistics; probability distribution and sampling distribution; least squares and maximum likelihood methods of estimation; tests of hypothesis (F, t and $\chi 2$); correlation and regression (simple and multiple); regression modeling and checking for assumptions; analysis of count of score data; non-parametric methods; introduction to some multivariate methods; design of experiments; CRD, RBD, LSD and split-plot design; considerations to treatment structure and quantitative treatments; analysis of covariance; combined analysis of multi-site and/or multiyear data; stability regression (for plant sciences) and meta-analysis (for animal sciences); analysis of repeated measurements; experiments in farmers' fields; and problem data.

BCH 728 General Biochemistry (2+1)

Introduction, cell organelles – structure and functions; Aqueous medium of the protoplasm, physical properties, biological importance, pH, Henderson- Hassellbalch equation, physiological buffer system; Amino acids and peptides – general properties, structural features, protonic equilibria and ionic structures, the peptide bond, peptides and polypeptides; protein – solubility classification, structure and function of a protein hemoglobin; enzyme- catalysis, nature of enzymes, specificity, active site and substrate binding enzyme; Hormones – classification and properties, kinetics; bioenergitics – free energy concept, standard energy changes; carbohydrate metabolism; lipids, phospholipids and steroids, bilayer lipid membrane; nucleotide, nucleic acids; protein metabolism; Polarity and non-polarity of biological substances, quantitative estimation and biochemical assay through spectrophotometer, chromatography and electrophoresis; preparation of buffer solutions, detection and quantification; carbohydrates, lipids, proteins and nucleic acids isolation, purification of enzymes, assay of important enzymes, characterization of different biochemical substances through spectrophotometry; Separation and quantification through chromatograph; Electrophoresis for protein and nucleic acid separation.

C. Courses from Major Departments

A student must enroll a minimum of 12 credit hours from the major departments (Animal Nutrition and Fodder Production, Livestock Production and Management, and Animal Breeding and Biotechnology).

16. AQUACULTURE

Departmental Courses		Credit Hrs.
AQU 701	Fish Biology	2+1
AQU 702	Aquaculture Systems	3+0
AQU 703	Fish Nutrition and Feeding Management	2+1
AQU 704	Water Quality Analyses and Management for Aquaculture	2+2
AQU 705	Hatchery Management and Aquatic Animal Seed Production	2+1
AQU 706	Fisheries Management	2+0
AQU 707	Methods for Fish Biology	2+0
AQU 709	Aquatic Animal Health Management	2+1
AQU 790	Special Problem (Aqua-Internship)	0+2
AQU 799	M.Sc. Seminar	0+2
AQU 800	M.Sc. Thesis	0+6
AQU 899	Ph.D. Seminar	0+2
AQU 900	Ph.D. Dissertation	0+15

AQU 701 Fish Biology (2+1)

General characters and classification of fishes; study of different organ systems – skin and scales, fins and locomotion, digestive, respiratory, circulatory, excretory and reproductive system; sense organ; specialized organs in fishes, structural modification in fishes.

AQU 702 Aquaculture Systems (3+0)

Introduction: systems concept, overview of aquaculture and fisheries, potentials and constraints of aquaculture; Classification of aquaculture systems; Key components of sustainable aquaculture: production technology, environmental concerns, social-economic aspect; Major inland aquaculture systems: carp, tilapia, carnivorous species and prawn culture; Integrated aquaculture systems: rice-fish, vegetable-fish, livestock-fish, aquaculture- aquaculture; Coastal aquaculture systems; shrimp, shell fish, sea weed; Case studies.

AQU 703 Fish Nutrition and Feeding Management (2+1)

Introduction: role of natural food in aquaculture, limits for growth, critical standing stock and supplementary feed requirements, requirement for nutritionally balanced feeds, limiting factors; Nutritional physiology and behavior: digestive systems different fish species, fate of nutrients, feeding methods, feeding habits of fish and feed intake, digestibility estimation; Nutrient requirement of fish: essential and non-essential nutrients, protein and amino acid, energy, lipids and fatty acids, carbohydrates, minerals, vitamins; Feed resources for fish feeding; Feed additives; Feed formulation; Formulated pellet feed production; Cost-effective feeding methods; Case studies and economic analysis.

AQU 704 Water Quality Analyses and Management for Aquaculture (2+2)

Introduction: Importance and requirement of water quality in aquaculture, Aquatic ecosystems, Morphometry of water bodies and trophic status; Physical parameters; Chemical parameters; Biological parameters; Pond bottom management: pond sediment characteristics, pond liming; Nutrient dynamics: nutrient cycle, primary productivity, pond fertilization; Aquaculture intensification and water quality managements; Farm effluents and Environmental impacts; Management Practices: Good Aquaculture Practice (GAP), Better Management Practice (BMP), Aquaculture Code of conduct (CoC); Water treatment and Reuse; Case studies.

AQU 705 Hatchery Management and Aquatic Animal Seed Production (2+1)

Introduction: concept, rationale and issues of reproduction and breeding; Reproductive biology: spermatogenesis and oogenesis, biology of propagation, embryology; Environmental factors affecting reproduction; Teleost reproductive endocrinology; Fish Breeding methods, sources of seeds and brood fish management; Transportation of live fish seed & brood fish; Induced breeding; Hatchery design and management; Incubation and hatchling, fry and fingerlings rearing; Indicators to assess successfulness of breeding; Breeding procedures for economically important fish of Nepal; Applied genetics to culture fish; Economics of fish breeding; Current status of supply, demand and marketing networks of fish seed in country; Case studies.

AQU 706 Fisheries Management (2+0)

Aquatic resources: aquatic habitat, aquatic environment, fisheries resources, importance of fisheries to livelihood, needs for fisheries management; Fisheries Assessment**:** fishing gears and technique, fish population dynamic, stock assessment, catch assessment; Fisheries Management Strategies: strategies for regulation of fisheries, measure for regulation, existing national and regional laws and regulation, Nepal Aquatic Animal Protection Act, 1997, FAO Code of Conduct for Responsible Fisheries, fisheries enhancement, fisheries co-management, community based fisheries; Fisheries Management Planning: basic consideration for management planning, designing, Implementation of management plans, reviewing and amending management plans.

AQU 707 Methods for Fish Biology (2+0)

Research methods concept and design; methods for fish genetics; taxonomic methods; methods for respirometry; methods for fish growth; bioenergetic methods; methods for stress and acclimation; methods for aquatic toxicology; methods for fish reproduction; maintaining fishes for research and teaching.

AQU 709 Aquatic Animal Health Management (2+1)

Introduction: concept of fish parasites and diseases, classification of diseases, modes of disease transmission, interaction between host, environment, pathogen, human and disease, economic impact of fish disease; Defense mechanisms in fish: non-specific, specific; Protozoan diseases: nature and control measures; Disease caused by worms: nature and control measures; Disease caused by Crustaceans: nature and control measures; Fungal diseases: nature and control measures; Bacterial diseases: nature and control measures;

Viral diseases; Non-infectious disease or disease of miscellaneous origin; Common drugs and chemicals used in related treatments; Different methods of disease control / treatments; Prophylactic measures; Therapeutic measures; Planning fish health program.

AQU 790 Special Problem (Aqua-Internship) (+2)

Laboratory or field work-research, survey or case studies on identified problems, writing report and presentation.

17. EPIDEMIOLOGY AND VETERINARY PUBLIC HEALTH

Departmental Courses		Credit Hrs
VPH 601	General Epidemiology	2+1
VPH 701	Introduction to Veterinary Public Health	2+1
VPH 702	Environmental Hygiene and Sanitary Microbiology	1+1
VPH 703	Food Hygiene and Toxicology	2+1
VPH 704	Occupational Health	1+0
VPH 705	Advanced Epidemiology	2+1
VPH 706	Biostatistics	1+1
VPH 707	Viral Zoonoses, Recognition, Prevention and Control	1+1
VPH 708	Bacterial Zoonoses, Recognition, Prevention and Control	1+1
VPH 709	Parasitic Zoonoses, Recognition, Prevention and Control	1+1
VPH 710	Food-borne Infections and Intoxication, Prevention and Control	1+0
VPH 711	Herd Health Management and Biosecurity	2+1
VPH 712	Veterinary Economics	2+1
VPH 713	Organic Farming and Bio Products	1+0
VPH 799	M. Sc. Seminar	0+1
VPH 800	M. Sc. Thesis	0+6

VPH 601 General Epidemiology (2+1)

Definition, scope and concepts of epidemiology, disease ecology, determinants and patterns of disease, epidemiological surveys, study design, measures of disease occurrence, outbreak investigation, estimation of disease incidence and prevalence, measures of association, estimation of risk, clinical and experimental trials, bias and confounding, diagnostic testing and it's interpretation, life table, principles of disease control, eradication and elimination, surveillance and monitoring, orientation on national and international disease reporting system. Use of EPIINFO, EPISCOPE, VETSTAT software for epidemiological investigation

VPH 701 Introduction to Veterinary Public Health (2+1)

Definitions, veterinarian's role in public health and food safety, veterinary legislation, veterinary public health administration, organization and functions of VPH agencies in Nepal and abroad, veterinary inspection of farms, hatcheries and feed industries and food processing plants, veterinary sanitary certification, zoonoses, classification of zoonoses, role of wild animals as maintenance host of zoonoses, strategy for prevention and control of zoonoses, consumer education and awareness

VPH 702 Environmental Hygiene and Sanitary Microbiology (1+1)

Definitions, veterinarian's role in environmental protection, principles of environmental hygiene in the prevention of communicable diseases, air pollution, soil pollution, water pollution, water quality management, animal waste, animal excreta, farm house waste, abattoir waste as potential health hazards, waste disposal, carcass disposal, sampling of water, air, soil for sanitary evaluation.

VPH 703 Food Hygiene and Toxicology (2+1)

Definitions, concept of food hygiene, impact of environmental sanitation on foods of animal origin, microbiological standards and quality control of foods of animal origin and animal feed, detection and quantification of drug residues, chemical contaminants and toxins in food, importance and maintenance of abattoir hygiene, meat inspection, food adulteration practices in Nepal and their control, personnel and kitchen hygiene

VPH 704 Occupational Health (1+0)

Definitions, concepts of occupational health, occupational health hazards and exposures, occupational diseases and it's classification, prevention and control of occupational diseases, personal safety measures.

VPH 705 Advanced Epidemiology (2+1)

Epidemiological modelling and it's use, decision tree analysis, survival analysis, import risk analysis, contingency planning, detection of presence and absence of disease in herd or population, herd health management, use of geographical information system, use of EPIZOO and TADINFO software programme for epidemiological analysis

VPH 706 Biostatistics (1+1)

One sample problems-tests and sample size, two sample problems-test and sample size, contingency table analysis, mantel-haensel technique, analysis of variance, simple regression analysis, correlation and regression, application of linear and non-linear regression, multiple regression, time series analysis.

VPH 707 Viral Zoonoses, Recognition, Prevention and Control (1+1)

Epidemiology of viral zoonoses, transmission of viral zoonoses, diagnosis of viral zoonoses, prevention and control of viral zoonoses, vaccination against viral zoonoses, rabies, viral influenza, nipah virus infection, vector-borne viral infections, Japanese encephalitis, west nile virus infection.

VPH 708 Bacterial Zoonoses, Recognition, Prevention and Control (1+1)

Epidemiology of bacterial zoonoses, transmission of bacterial zoonoses, diagnosis of bacterial zoonoses, prevention and control of bacterial zoonoses, vaccination against bacterial zoonoses, brucellosis, bovine tuberculosis, anthrax, plague, rat bite fever, borreliosis, food poisoning.

VPH 709 Parasitic Zoonoses, Recognition, Prevention and Control (1+1)

Epidemiology of parasitic zoonoses, transmission of parasitic zoonoses, diagnosis of parasitic zoonoses, prevention and control of parasitic zoonoses, lifecycles of parasites, geohelminths and biohelminths, toxoplasmosis, taeniasis and cysticercosis, hydatidosis, trichinosis, visceral larva migrans, cutaneous and visceral leishmaniasis, schistosomiasis, fascioliasis

VPH 710 Food-borne Infections and Intoxication, Prevention and Control (1+0)

Definitions, epidemiology of food-borne infections, outbreak investigation of food poisoning, diagnosis of food-borne infections, prevention and control of food-borne infections and intoxication, salmonellosis, listeriosis, campylobacteriosis, mycotoxins, aflatoxicosis.

VPH 711 Herd Health Management and Bio-security (2+1)

Concept of herd health management, bio security measures and it's use, herd health and production parameters, health record keeping, sampling microclimatic conditions and herd health, procedure for determination of herd disease prevalence, cut-off point, interpretation of diagnostic test results, metabolic profile and micronutrients, vaccine and biological products used for disease prevention and optimization of livestock productivity.

VPH 712 Veterinary Economics (2+1)

Introduction to economics, definition, terms and basic concepts, livestock projection and planning, principles of project evaluation, ZOPP analysis, cost-benefit analysis of the disease control program, sensitivity analysis, estimation of socio-economic losses due to infection and diseases.

VPH 713 Organic Farming and Bio Products (1+0)

Principles of organic farming, veterinary drug and toxic residues in food products, good farm practices, good hygienic practices, good manufacturing practices, principles and practice of hazard analysis and critical control points (HACCP), bio products and it's importance.

18. VETERINARY MEDICINE

Departmental Courses		Credit Hrs
VMC 701	Diseases of Cattle, Horse, Sheep and Goat-I	2+1
VMC 702	Diseases of Cattle, Horse, Sheep and Goat-II	2+1
VMC 703	Metabolic Diseases of Cattle, Sheep and Goat	2+1
VMC 704	Diseases of Dog and Cat	2+1
VMC 705	Diseases of Swine	1+0
VMC 706	Infectious Diseases of Horse, Sheep and Goat-I	2+1
VMC 707	Infectious Diseases of Horse, Sheep and Goat-II	2+1
VMC 708	Poultry Diseases	1+1
VMC 709	Diseases of Animals Caused by Toxicant	1+1
VMC 710	Wild life Medicine	2+1
VMC 711	Advanced Studies in Protozoan Diseases	1+1
VMC 799	M. Sc. Seminar	0+1
VMC 800	M. Sc. Thesis	0+6

VMC 701 Diseases of Cattle, Horse, Sheep and Goat-I (2+1)

General systemic state, diseases of alimentary tract, liver, cardiovascular system, blood and blood forming organs and respiratory tract. Diagnostic test, treatment and control of the diseases of alimentary, respiratory and cardiovascular system.

VMC 702 Diseases of Cattle, Horse, Sheep and Goat-II (2+1)

Diseases of urinary system, nervous system, the skin and musculoskeletal system and diseases of the newborn. Diagnostic tests, treatment and control of the diseases of urinary, nervous, skin and musculoskeletal systems.

VMC 703 Metabolic Diseases of Cattle, Sheep and Goat (2+1)

Metabolic diseases of cattle, horses, sheep and goats including diseases caused by nutritional deficiencies, physical and chemical agents and allergy, specific diseases of unknown or uncertain etiology. Attending cases in clinics and biochemical estimation of different constituents in blood, urine, cerebrospinal fluid in metabolic diseases.

VMC 704 Diseases of Dog and Cat (2+1)

Disease of alimentary tract, respiratory system, urinary system, blood, heart, skin and nervous system, metazoan, bacterial, viral, mycotic and allergic diseases. Diagnostic tests and treatment of non-infectious and infectious diseases of dog and cats; attending to the clinical cases of canine and felines in the clinics.

VMC 705 Diseases of Swine (1+0)

Etiology, transmission, symptomatology, diagnosis, differential diagnosis, treatment and control of infectious and non-infectious diseases of swine.

VMC 706 Infectious Diseases of Cattle, Horse, Sheep and Goat-I (2+1)

Principles of host parasite relationship, mechanism of infection and resistance; diseases caused by bacteria and fungi. Important exotic diseases. Diagnostic tests treatment trials and preventive measures for the bacterial and fungal disease of cattle, horse, sheep and goat.

VMC 707 Infectious Diseases of Cattle, Horse, Sheep and Goat-II (2+1)

Detail studies of viral, rickettsial and protozoan disease. Notifiable diseases of Nepal. Diagnostic tests and preventive measures for viral rickettsial and protozoan disease of cattle, horse and goat.

VMC 708 Poultry Diseases (1+1)

Detailed accounts of infectious and non-infectious diseased of poultry. Diagnostic tests, chemotherapeutic and prophylactic measures of poultry diseases.

VMC 709 Diseases of Animals Caused by Toxicants (1+1)

Etiology, symptoms, methods of diagnosis, treatment and prevention of poisonings in animals. Collection of materials and its analysis for toxicants from experimental/clinical cases of poisonings and their treatment.

VMC 710 Wild Life Medicine (2+1)

Concepts in ecology and conservation biology, conservation medicine and ecosystem health, conservation strategies management issues: lab animal, exotic practice and poultry production, zoos and wild life; diagnostic and therapeutic challenges, immobilization and restraint, fish and amphibian medicine, avian viral, bacterial, fungal parasitic, toxic, metabolic diseases, captive birds highlights, wild bird highlight, captive carnivore medicine, captive ungulate medicine, rabbit medicine.

VMC 711 Advanced Studies in Protozoan Diseases (1+1)

Investigation of various protozoan diseases affecting cattle, horse, sheep and goat. Experimental production of protozoan diseases in animals and to study their pathogenesis, diagnosis and therapeutic measures.

19. MICROBIOLOGY

Departmental Courses		Credit Hrs
VMI 701	General Bacteriology	2+1
VMI 702	Systematic Bacteriology	2+1
VMI 703	Veterinary Mycology	2+1
VMI 704	General Virology	2+1
VMI 705	Advanced Immunology	3+0
VMI 706	Systematic Animal Virology	3+1
VMI 707	Principles of Immunology	2+1
VMI 708	Microbial Toxin	2+1
VMI 709	Clinical Microbiology	0+2
VMI 710	Clinical Immunology	0+2
VMI 711	Food Microbiology	2+1
VMI 712	Production and Standardization of Veterinary Biological	2+1
VMI 799	M. Sc. Seminar	0+1
VMI 800	M. Sc. Thesis	0+6

VMI 701 General Bacteriology (2+1)

Introduction to historical development of cellular organization, genetic and chemical characteristics of eucaryotic and prokaryotic cells, systematic in bacteriology-classification, nomenclature and identification, genetic characterization and numerical taxonomy, bacterial cell structure and physiology, antigenic structure of bacteria, bacteriophages- temperate phages, lysogeny and lysogenic conversion, bacterial genetics-bacterial variation, genetic transfer mechanism plasmids, transposons and drug resistance. Recombinant DNA technology, hybridoma technology in relation to vaccinology and immunodiagnosis, molecular basis of pathogenecity.

VMI 702 Systematic Bacteriology (2+1)

Principles of classification of bacteria, recent trends in classification, taxonomy, occurrence, pathogenecity, morphology, cultural characteristics, biochemical and immunological characteristics of the followings genera of bacteria; spirochete, leptospira, campylobacter, pasteurella, yersinia, bordetella, bacteriodes, fusobacterium, pseudomonas, escherichia, salmonella, shigella, klebsiella, proteus, brucella, staphylococcus, streptococcus, bacillus, clostridium, listeria, actinomyces, nocardia, mycobacterium, erysepelothrix, and corynebacterium, mycoplasma and rickettssia including rickettsial diseases.

VMI 703 Veterinary Mycology (2+1)

Classification and taxonomy of fungi, study of pathogenic moulds and yeast, isolation and identification of fungi causing cutaneous, subcutaneous and deep mycoses. Mechanism of immunity in fungal infection, diagnosis and chemotherapy of fungal disease.

VMI 704 General Virology (2+1)

Origin, nature, morphology, physical and chemical structure of viruses; serological properties, effect of environment; virus host interaction and interferon's, replication, variation and genetics and interaction; pathogenesis and immunity in viral disease; virus in relation to neoplasm; classification of animal viruses.

VMI 705 Advanced Immunology (3+0)

The structural basis of antibody and antigen in immune responses, mechanism of action of complement *in vivo* and *in vitro, i*mmune reactions, cellular immunity in hypersensitivity, tissue transplantation and tumor surveillance system, *in vitro* correlates of cellular immunity, cell cooperation in immune response, mechanism of immunity to viruses, bacteria, fungi and parasites, immunology of reproduction, nutrition and immunity, non-specific stimulation and other topics on current status of veterinary immunology.

VMI 706 Systematic Animal Virology (3+1)

History, host-range, physico-chemical, epidemiological, immunobiological characteristics, pathogenesis and control of animal diseases caused by various RNA and DNA viruses.

VMI 707 Principles of Immunology (2+1)

History of immunology, antigens, adjuvant, immune systems; organs, tissue and cells; immunoglobulins, monoclonal antibodies, theory of antibody diversity, complements system classical and alternate; cellular interaction in the immune response. MCH, cell mediated immune response, lymphokinins, immunoregulation, immunological tolerance, hypersensitivity, mechanism in immunity; innate resistance and specific immunity.

VMI 708 Microbial Toxin (2+1)

The source of microbial toxin- bacteria and fungi, nature of microbial toxin and their classification, isolation, purification and characterization of toxins from different microorganism producing infection and intoxications.

VMI 709 Clinical Microbiology (0+2)

Preparation and standardization of different media used in clinical microbiology; guidelines for collection of samples; isolation and identification of bacteria and fungi; antibiotic sensitivity of microorganism from clinical specimens, diagnosis of microbial disease by serological methods, bacteriocin typing, pathogenicity test in cell culture/lab animals.

VMI 710 Clinical Immunology (0+2)

Preparation of reagents, estimation of gammaglobulins, quantitation of immunoglobulins, nephlometry, AGPT, CFT, HA, HI, ELISA, FAT, RIA, separation of lymphocyte, LMIT, LST, grafts, acceptation and rejection, phagocytic index.

VMI 711 Food Microbiology (2+1)

Microbial flora of natural and processed foods, principles of microbial standardization of foods, food borne infection and intoxications, principle of food preservation and storage, biochemical basis of microbial spoilage of natural and processed foods.

VMI 712 Production & Standardization of Veterinary Biological (2+1)

Methods involved in the production of veterinary biological and their standardization, provisions of drug control act in relation to veterinary biological production and standardization, WHO and FAO standards for veterinary biological.

20. VETERINARY PHARMACOLOGY

Departmental Courses		Credit Hrs
VPM 701	Molecular Pharmacology	2+1
VPM 702	Advanced Toxicology	2+1
VPM 703	Pharmacokinetics	2+1
VPM 704	Neuropharmacology	2+1
VPM 705	Advanced Chemotherapy	2+1
VPM 706	Autonomic Pharmacology	2+1
VPM 707	Ethnopharmacology	1+1
VPM 708	Endocrine Pharmacology	2+1
VPM 709	Pharmacology of Autocoids	1+1
VPM 710	Chemotherapy of Parasitic Diseases	1+1
VPM 711	Cardiovascular and Renal Pharmacology	1+1
VPM 712	Pharmacology of Gastrointestinal Tract	1+1
VPM 713	Phamacometrics	0+2
VPM 714	Immunopharmacology	2+1
VPM 715	Nutritional Pharmacology	2+0
VPM 799	M. Sc. Seminar	0+1
VPM 800	M. Sc. Thesis	0+6

VPM 701 Molecular Pharmacology (2+1)

Physio-chemical properties and structure of drug molecules; classification of drug receptors, methods of characterization, identification and isolation of receptors; forces involved in binding of drugs to receptors, receptor conformation and configuration and structure-activity relationship; theories of drug-receptor interactions, analysis of dose response relationship and non-molecular mechanism of drug action, gene therapy.

VPM 702 Advanced Toxicology (2+1)

Principle of toxicology, types of toxicity, qualitative and quantitative aspects of metabolism of toxicants, injuries caused by toxicants, cellular, sub-cellular and molecular target of action, mechanism of action of specific toxicants causing morphological physiological and biochemical changes in the liver kidney lungs adrenal and CNS, reproductive and haemopoietic systems, toxicology of mineral or inorganic substance, organic compounds, solvents, vapors, poisonous plants, toxins of animal and plant origins, radiation hazards, regulatory and forensics toxicology.

VPM 703 Pharmacokinetics (2+1)

Principles of pharmacokinetic, absorption, distribution, biotransformation and excretion of drugs, factors modifying the kinetics of drugs, pharmacokinetic models and their applications, determination of various pharmacokinetics parameters and their significance in drug pharmacodynamics, bioavailability, volume of distribution and protein binding of drugs.

VPM 704 Neuropharmacology (2+1)

Pharmacology of neurotransmitters, types of transmitter present in different systems, co-transmitter theory, pharmacological organization of central nervous system, pre-anesthetics medication, intravenous and other parenteral anesthetics, inhalation anesthetics, hypnotics and sedatives, psychotropic agents, drugs affection behavior, narcotic analgesics and analgesic antagonists, non-narcotic analgesics, CNS stimulants

VPM 705 Advanced Chemotherapy (2+1)

History and general consideration, principle of anti-microbial use, characteristics of chemotherapeutic agent, mechanism of action of different antibiotics, sulfonamides, penicillin miscellaneous antibacterial agents, Recent advances in antifungal and antiviral anti-protozoan and antituberculosis drugs; antiseptics and disinfectants; chemotherapy of neo-plastic diseases.

VPM 706 Autonomic Pharmacology (2+1)

Anatomical and physiological consideration of autonomic nervous system, neurohumoral transmission, synthesis and release mechanism of neurotransmitters of sympathetic and parasympathetic system, adrenergic drug, inhibiting adrenergic nerves adrenergic receptors and blocking of those receptors, cholinergic agonists, antiholinesterase agents antimuscarinic drugs, gang ionic stimulating and blocking agent, neuromuscular blocking agents.

VPM 707 Ethnopharmacology (1+1)

General survey on the development in the field of indigenous drugs, screening methods indigenous medicinal plants, pharmacology of important indigenous drugs.

VPM 708 Endocrine Pharmacology (2+1)

General consideration, classification of different hormones in terms of mechanism of action, hormones of pituitary gland and adrenal cortex, hormones affecting reproduction, anabolic steroids, thyroid and antithyroid drugs, parathyroid and calcitonin, insulin and glucagons, hormonal regulation of calcium and phosphorus homeostasis.

VPM 709 Pharmacology of Autocoids (1+1)

General considerations, histamine and antihistamines, serotonin and antiserotonins, purine derivative- AMP, ADP, ATP and their antagonist; cyclic nucleotides-cAMP, cGMP, prostaglandins, kinins, bradykinin, angiotensin, kallikrein and other kinis; amino acids; glycine, GABA, glutamic acid plasmakinins and other vasoactive agents etc.

VPM 710 Chemotherapy of Parasitic Diseases (1+1)

Control of external parasites, antinematodal drug, ectoparasiticides, anthelmintics, antiprotozoan drug and coccidiostats, anticestodal and antitrematodal drugs, antitrypanosomal and drug used against other parasitic infections.

VPM 711 Cardiovascular and Renal Pharmacology (2+1)

Principles of electro-cardiography, digitalis and other inotropic agents, antiarrthymic drugs, vasodilator mechanism and vasodilator drugs, endothelial derived factors (EDF), haemostatic and anticoagulant drugs, antianemic drugs, pharmacology of drugs affecting volume and composition of body fluids; water and osmotic diuretics, mercurial diuretics, inhibitors of carbonic anhydrasse, thiazides, high ceiling and potassium sparing diuretics: aldosterone antagonists, xanthine derivatives and uricosuric diuretics; anti-diuretic hormone and inhibitors of tubular transport.

VPM 712 Pharmacology of Gastrointestinal Tract (1+0)

Absorption of drugs from GIT, antacids, mechanism of regulating secretion of HCl, emetics and antiemetics, cathartics, intestinal astringents and antidiarrheal agents, aspects of ruminant pharmacology.

VPM 713 Pharmacometrics (0+2)

Introduction, organization of screening of multidimentional screening procedures and gross observation methods, ouantal and graded responses, calculationof ED_{50}, TD_{50}, LD_{50} and therapeutic index, bioassay, screening of new drugs on nervous and respiratory systems, skeletal and smooth muscles, test for evaluating antiarrhythmic, anti-hypertensive, anti-hyperglycemic and anticholesterimic agents.

VPM 714 Immunopharmacology (2+0)

General principles of immune response, immunological basis of drug allergy. immediate and delayed hypersensitivity; nature of chemical mediators, immunological drug tolerance and physical dependence, pharmacological control of immune response; immunoragulants and their application in asthma, arthritis, cancer, dermatology and organ transplant etc.

VPM715 Nutritional Pharmacology (2+0)

Fat soluble vitamins, water-soluble vitamins, calcium and phosphorus, trace elements, growth promoters, probiotics, digestive enzymes.

21. VETERINARY PARASITOLOGY

Departmental Courses		Credit Hrs
VPA 701	Platyhelminthes	3+1
VPA 702	Nemathelminthes	3+1
VPA 103	Protozoology	2+1
VPA 704	Parasitological Techniques	0+3
VPA 705	Immunoparasitology	1+1
VPA 706	Entomology and Acarology	2+1
VPA 707	Parasitic Zoonosis	2+1
VPA 708	Clinical Parasitilogy	1+2
VPA 709	Poultry Parasitology	1+1
VPA 710	Fish Parasitology	1+1
VPA 799	M. Sc. Seminar	0+1
VPA 800	M. Sc. Thesis	0+6

VPA701 Platyhelminthes (3+1)

History, classification, detailed study of the main orders and chief families of veterinary importance, occurrence, distribution, bionomics, life cycle, pathogenesis, symptoms, anatomical changes and diagnosis of parasite belonging to the families: Cestoda-Dipylidiidae, Mesocestoidae, Anoplocephalidae, Thysanosomidae, Davaineidae, Dilepididae, Hymenolepididae, Taeniidae and Diphyllobothridae, Trematode-Dicrocoellidae, Opisthorchiidae, Fasciolidae, Echinostomidae, Heteropydae, Plagiorchiidae, Notocotylidae, Prosthgonimidae, Paragonimidae, Troglotrematidae, Cyclocoelidae, Paramphistomatidae, Strigeidae, Diplostomatidae, Clinostomatidae, Brachylaemidae and Schistosomatidae.

VPA 702 Nemathelminthes (3+1)

History, classification, detailed study of the main orders and chief family of veterinary, importance, occurrence, distribution, bionomics, life cycle, pathogenesis, symptoms, anatomical changes and diagnosis of parasite belonging to the families: Ascaridae, Anisakidae, Oxyuridae, Heterakidae, Subuluridae, Rhabditidae, Strongyloididae, Strongylidae, Trichonematidae, Stephanuridae, Syngamidae, Ancylostomatidae, Amidostomidae, Trichostryngylidae, Ollulanidae, Dictyocaulidae, Metastrongylidae, Protostrongyhlidae, Filaroididae, Spiruridae, Thelaziidae, Acuaridae, Tetrameridae, Physalopteridae, Gnatostomatidae, Filariidae, Setariidae, Onchocercidae, Dracunculidae, Trichinelidae, Truchuridae, Capillariidae and Dioctophymatidae; Acanthocephala-Polymorphidae and Oligacanthorhynchidae; Annelida-Haemadipsidae and Hirudinidae

VPA 703 Protozoology (2+1)

Classification, biology, motility, respiration, nutrition, excretion, secretion, reproduction and cultivation detailed study of ecology, habitat geographical distribution, morphology, life cycle, pathogenesis, symptoms, anatomical changes, diagnosis including immunological and serological studies, prognosis of parasitic infections under the following families: Endamoebidae, Trypanosomatidae, Hexamitidae,

Monocercomonadidae, Trichomonadidae, Haemogregarinidae, Eimeriidae, Sarcosystidae, Plasmodiidae, Babesiidae, Theleriidae and Balantidiidae.

VPA 704 Parasitological Techniques (0+3)

Microscopy, micrometry, microtomy for serial section of morbid tissues, histopathological and histochemical technique with attendant parasitic infection, demonstration of the equipments used in parasitological techniques, collection fixation, staining, while mounting and identification of parasites, Camera Lucida drawings, culturing techniques for important protozoan and helminthes and breeding of arthropods

VPA 705 Immunoparasitology (1+1)

Host parasite relationship, types of immunity, resistance to parasitic infection, antigen-antibody reaction, antigenic characters of parasites, cellular and humoral factors in immunity to parasite, latent infection premunition, self-cure phenomena, cutaneous and visceral larva migrans, allergy, serologic and allergic reaction, irradiation and its hazards, vaccination, application of bio-technology.

VPA 706 Entomology and Acarology (2+1)

Classification, role of arthropods as biological vector, detailed study of their main orders and chief families, occurrence distribution, life history, seasonal history, significance of arthropods belonging to the following families: Culicidae, Ceratopogonidae, Simulidae, Psychodidae, Tabanidae, Oestridae, Cuterebridae, Glossinidae, Calliphoridae, Muscidae, Sarcophagidae, Hippoboscidae, Gasterophilidae, Linguatulidae, Reduviidae, Cimicidae, Procephalidae, Pulicidae, Menoponidae, Pediculidae, Linognathidae, Searabacidae, Tenebronidae, Argasidae, Ixodidae, Dermanyssidae, Macronyssidae, Sarcoptidae, Psoroptidae, Demodicidae, Trombiculidae, Coverage of applied arthropods belonging to Crustacea, Diplopoda, Chilopods and Coleoptera.

VPA 707 Parasitic Zoonosis (2+1)

Detailed study of major protozoan, arthropods and helminthes of public health importance with particular emphasis, on animal reservoirs, mode of infection, geographical distribution and seasonal occurrence, epidemiology of parasitic zoonosis and their relation to animal hosts, human habits, customs and occupations role of the intermediate hosts in dissemination the infection among human beings and animals.

VPA 708 Clinical Parasitology (1+2)

Study of clinical cases, their history, symptoms, gross as well as microscopic examination of secretions and excretion, collection and dispatch of material to laboratory for diagnosis, animal sub inoculation tests, blood and biopsy smear examinations, histopathology of effected organs.

VPA 709 Poultry Parasitology (1+1)

History, classification, geographical distribution, lifecycle, pathogenesis, symptoms, treatment and control of digestive tract trematodes, cestodes, nematodes and protozoa;

liver protozoa, circulatory system nematodes, urogenital system and oviduct trematodes, respiratory system trematodes and arthropods; skin and subcutaneous tissues trematodes, nematodes and arthropods; muscle and tendon protozoa, eye nematodes.

VPA 710 Fish Parasitology (1+1)

History, classification, geographical distribution, life cycle, pathogenesis, symptoms, treatment and control of digestive tract trematodes, nematodes, protozoa, vascular system and gills trematodes, protozoa, liver protozoa, air bladder trematodes, muscle connective tissue and cartilage trematodes, protozoa, central nervous system protozoa, reproductive system protozoa, skin and subcutaneous tissue trematodes, monogenea trematodes, digenea trematodes and protozoa.

22. VETERINARY PATHOLOGY

Departmental Courses		Credit Hrs
VPP 701	Advanced Systemic Pathology	2+1
VPP 702	Poultry Pathology	2+1
VPP 703	Advanced Histopathology and Histochemistry	1+2
VPP 704	Advanced Clinical Pathology	1+2
VPP 705	Pathology of Neoplasm	1+2
VPP 706	Pathology of Nutritional Disease	2+1
VPP 707	Laboratory Technique and Diagnosis	0+3
VPP 708	Hematology	1+1
VPP 709	Surgical Pathology	2+1
VPP 710	Parasitic Pathology	1+1
VPP 711	Advanced Pathology of Infectious Disease	2+1
VPP 712	Necropsy Diagnosis	0+1
VPP 799	M. Sc. Seminar	0+1
VPP 800	M. Sc. Thesis	0+6

VPP701 Advanced Systemic Pathology (2+1)

Cardiovascular system- mulberry heart disease, polyarteritis nodosa, thromboangitis oblitrans, homeopoitic system- role of leukocyte and response in disease, respiratory system- pathology of upper respiratory tract, chronic progressive pneumonia, and tumors; digestive system- disease of salivary glands, gall bladder, bile ducts, and pancreas; urinary system- ultrastruture and function; nervous system- CSF in neuropathology; reproductive system- freemartin white heifer disease-bursitis-abortion-pathology of reproductive tract of birds; mastitis in animals, orchitis, pathology of prostate glands; musculoskeletal system-congenital abnormalities, osteodystrophy, fracture, tumors, disease of joints, myositis, azoturia, white muscle diseases, tumors; endocrine glands-general outline of hormonal action of various disease conditions of glands; skin- terms used in various skin disease-ionization, maminitis, and tumors; eye and ear- congenital anomalies, various disease conditions of eye and ear.

VPP 702 Poultry Pathology (2+1)

Disease caused by the deficiency of minerals and vitamins; bacterial disease- bacillary white diarrhea, paratyphoid, fowl typhoid, fowl cholera, T.B., coryza, avian mycoplasmosis, cell granuloma, ulcerated enteritis; fungal disease- aspergillosis, thrush, sarcospoidiosis; viral disease – A.L.C, M.D., IB, ILT, RD, AE, fowl pox, infectious synovitis, fowl plague, duck viral hepatitis, avian monocytosis; parasitic disease-nematodes, cystodes and trematodes and external parasites; protozoan disease- coccidiosis, black head, leucocytozoan infection, toxoplasmosis and spirochetosis; poisons and toxin, common neoplasm of poultry.

VPP 703 Advanced Histopathology and Histochemistry (1+2)

Histochemistry- introduction, definition, microscopic histochemistry, histological development, and limitations of histochemistry criteria of accuracy; preparation of tissue-fixation, embedding, frozen section method, feeze substitution method, sectioning with

and without cryostat; acetone fixation and embedding and general suggestions; Enzymes-general, alkaline phosphatase, gomori test, acid phosphotase, gomori, method, barks and Anderson method; DOPA-OXIDASE- Loid law DOPA oxidase method, succinic dehydroxygenase- nitro BT method; lipase or nonspecific esterases method;
carbohydrate- schiff's reagent and its preparation, PAS test for carbohydrate; glycogen-best's carmine method, alcian blue for acid mucopolysaccharide; lipid- Sudan IV or oil red 'O' for lipids; nucleic acids- feulgen test for DNA, pyronin methyl green for DNA and RNA, ribonuclease extraction; calcium- cobalt substitution method, vonkossa method, alzarina red-S method; iron-pearl's method.

VPP 704 Advanced Clinical Pathology (1+2)

Hematology- basic concept of erythrocyte leukocyte, reticulocytes and thrombocyte, production; study of blood picture in various disease conditions and their interpretation; cytology- body cavity effusions, CSF, synovial fluid, vaginal fluid, transtracheal aspiration, biopsy, solid tissue cytology; water, electrolyte and acid base- total body water and somollity, determination of blood, gases and electrolyte, disorders of electrolyte and metabolic acid base balance, disorders of respiratory function; protein, lipid and carbohydrate-plasma protein, lipids and carbohydrate; liver-hepatic abnormalities detection by lab test, hepatic lab test and categories of hepatic lesions and lab test patterns; urinary system- urine analysis and smears renal function; muscle- serum enzymes of muscle, other changes in muscle disease; digestive system- laboratory detection of pancreatic inflammation and necrosis and detection of maldigestion and malabsorption, other test for specific GIT disorders; bone marrow and CSF examination and their interpretation, examination of urine, faces and skin scraping of various pathological condition and its interpretation, mastitis test; calcium- regulatory hormones and disease of abnormal mineral (Ca, P, Mg) metabolism.

VPP 705 Pathology of Neoplasm (1+2)

Definition, nature of neoplasia, neoplastic cells, mitosis, difference between neoplasia and hyperplasia; causes of neoplasm, classification, spread of tumors, diagnosis of cancer, tumor immunity, cancer therapy; histology and incidence of various tumors of animals and poultry.

VPP 706 Pathology of Nutritional Disease (2+1)

Pathology of excess and deficiency of food, protein, carbohydrates, fats, minerals and vitamins.

VPP 707 Laboratory Technique and Diagnosis (0+3)

Microscopy, principal of light microscopy; magnification, parts of microscope, dark field microscope, EM, micrometry and camera lucida; histopathology, collection fixation processing and staining of tissues; mecropsy technique, systemic PM of different species of animals, examination of organs, collection of material for microbiological, histopathological and chemical examination; writing PM reports, autopsy hygiene; museology, preservative methods of preservation, storage of specimens, routine preparation of specimens for museum, special methods, museum room and display of

museum specimens; maintenance of specimens records; Photography, gross and microphotography; clinical pathology, hematology, urine examination for pathological constituents, fecal examination, milk examination for mastitis.

VPP 708 Hematology (1+1)

Function of blood, haematopoiesis, leucopoiesis, bone marrow evaluation; collection of blood, counting of reticulocytes, basophill, platelets and its interpretations; anemia, etiology, classification, blood picture and diagnosis; leukemia, study of haemograms of various diseases conditions.

VPP 709 Surgical Pathology (2+1)

Inflammation and repairs, hemorrhages, shock, trauma-burns, wound, infection, abbscess tetanus, gangrene; neoplasm, classification, spread, tumor, biopsy, methods of diagnosis, cardiovascular system, developmental anomalies of heart, traumatic pericarditis, vegetative endocarditis, atheroma, aneurysm, varicose vein, thrombosis; respiratory system, cleft plate, roaring, edema of lung, digestive system, caries choke, tympany, traumatic reticulities, displacement of stomach, ulcer torsion, vulvulus, hernia, enteroliths, hair balls, gall stone, hydatid cyst; urinary system, developmental anomalies, polycystic kidneys, hydronephrosis, urolithiasis; male genital system, orchitis, phimosis, paraphymosis, hydrocel; female cystic ovary, hydrosalphinx, pyometra, prolapse, mastitis, and pathology of mastitis and test; musculoskeletal system, osteodystrophy, fracture, healing, exostosis, arthritis, myositis, atrophy of muscle, intervertebral disc protrusion; vervous system, hydrocephalous, coeneurus cerebralis, specific diseases like TB, actinomycosis, tetanus etc.

VPP 710 Parasitic Pathology (1+1)

Pathology of disease caused by trematodes, cestodes, nematodes, insects and their larvae.

VPP 711 Advanced Pathology of Infectious Disease (2+1)

Bacterial, leprosy in buffalo, epizootic lymphangitis, bovine lymphangitis, colibacillosis of new born, gut edema of swine, vibrio infection, winter dysentery of cattle, caseous lymphangitis; viral, lumpy skin disease, contagious ecthyma, African swine fever, blue tongue, equine encephalitis, equine infectious anemia; fungus, mycotoxin, other mycotic conditions; rickettsia, heart water, epeerythrozoanosis, and heamobartinellosis; protozoa, globidiasis, fowl malaria, leucocytozoon, hepatozon cani; helminthetic- euretramiasis, paragonimiasis, ophisthorcic; nematodes, stronglyoidosis.

VPP 712 Necropsy Diagnosis (0+1)

Systemic postmortem examination of carcasses of different species of animals and diagnosis.

23. VETERINARY GYNAECOLOGY AND OBSTETRICS

Departmental Courses			Credit Hrs
VGO	**701**	**Advanced Gynaecology**	**2+1**
VGO	702	Advanced Obstetrics I	2+1
VGO	703	Infertility in Domestic Animals	2+1
VGO	704	Genital Diseases in Relation to AI	1+1
VGO	705	Physiopathology of Reproduction in Domestic Animals	2+1
VGO	706	Injuries and Disease in Relation to Parturition	2+1
VGO	707	Gynaecology and Obstetrics of Dog and Cat	2+1
VGO	708	Embryotransfer Technology	1+1
VGO	709	Gynaecology of Sheep, Goat, Pig and Poultry	1+1
VGO	710	Advanced Study of Male and Female Infertility	2+1
VGO	711	Reproductive Endocrinology	2+1
VGO	712	Advanced Obstetrics II	2+1
VGO	713	Techniques in Andrology and Gynaecology	2+1
VGO	799	M. Sc. Seminar	0+1
VGO	800	M. Sc. Thesis	0+6

VGO 701 Advanced Gynaecology (2+1)

Anatomy of the female genital organs and ligaments; normal pregnancy, foetus and foetal adrenals, placentation; foetal blood circulation and nutrition; position of foetus in uterus; gestation period; age characteristics of the foetus; influence of pregnancy on the dam; pregnancy diagnosis; pseudo pregnancy; abnormal pregnancy due to abnormalities in dam and the foetus; vaginal prolapse; monstrosities, lethal-factors; paraplegia; antepartum; hernia uteri; abortion; abnormalities in placentation; hydropse of foetal membranes; extra-uterine pregnancy; torsion of the uterus, foetal maceration and mummification.

VGO 702 Advanced Obstetrics I (2+1)

Pelvimetry; introduction to courses, symptoms and stages of parturition, labour, primary and secondary uterine inertia; uterine rupture during gestation and near parturition; adhesions of uterus and its role in abnormal parturition, involution of uterus after normal and abnormal parturition; diseases and care of the new born, care of the post-partum dam; dystocia fetalis, dystocia maternal; incidences, basic and immediate causes of dystocia; history and evolution of obstetrical equipments; procedures for handling dystocia; mutation, forced extraction, technique of foetotomy including subcutaneous and percutaneous methods, caesarean section and hysterectomy.

VGO 703 Infertility in Domestic Animals (2+1)

Infectious and non- infectious factors causing infertility and sterility in male and female animals; anoestrus; cystic ovarian degeneration; repeat breeders and the management problems in the reproductive failure; impotentia coendii and impotentia generandii.

VGO 704 Genital Diseases in Relation to AI (1+1)

Artificial insemination in the control of genital diseases and the dangers thereof; pathological factors affecting the fertilizing capacity of sperms; effect of various abnormality; breeding soundness evaluation of bulls.

VGO 705 Physiopathology of Reproduction in Domestic Animals (2+1)

Endocrine diagnosis in reproductive disorders; principles of hormone therapy; cytogenetics in relation to reproduction; factors leading to early embryonic death; role of stress on conception, pregnancy and parturition and its mechanism; induction of parturition; foetomaternal relationship; superfoetation and superfecondation; induction of oestrus and oestrus synchronisation; abnormal sexual behaviour; spermatogenesis and its hormonal control.

VGO 706 Injuries and Diseases in Relation to Parturition (2+1)

Para plegia post-partum; contusions, lacerations and ruptures of uterus, cervix, vagina, perineum and injuries to the intestine. Prolapse of the uterus, vagina, urinary bladder and rectum; retention of placenta; puerperal intoxication; puerperal infectious diseases; placentophagia; metrorrhagia.

VGO 707 Gynecology and Obstetrics of Dog and Cat (2+1)

Anatomy of the female genital organs, ecy, normal pregnancy, foetus, placentation, gestation period, diagnosis and pseudopregnancy, abnormal pregnancy due to abnormalities in dam and the foetus, vaginal prolapse, herniation, abortion, abnormalities in placentation, extrauterine pregnancy, torsion of the uterus, fetal maceration and mummification, stages of parturition, labor, uterine inertia, diseases and care of the new borne and care of the post- partum dam.

VGO 708 Embryotransfer Technology (1+1)

Super ovulation, factors influencing super ovulation, techniques of ova collection; factors influencing quality of ova/embryos; methods of assessing embryo viability; short term maintenance and culture of embryos, embryos-cryopreservation; diseases transmission aspects, micro-manipulation of embryo-splitting and sexing; transfer of embryos-surgical and non surgical, embryo transfer and infertility management; induction of twinning.

VGO 709 Gynecology of Sheep, Goat, Pig and Poultry (1+1)

Comparative anatomy of the male and female genital organs of different species; normal pregnancy, fetus, placentation, gestation period, diagnosis and pseudopregnancy, abnormal pregnancy due to abnormalities in dam and the fetus; vaginal prolapse, herniation, abortion, abnormalities in placentation; extrauterine pregnancy, torsion of the uterus, fetal maceration and mummification, labor, stages of partution, uterine inertia, diseases and care of the new borne and care of the post- partum dam.

VGO 710 Advanced Study of Male and Female Infertility (2+1)

Hereditary and congenital abnormalities of the reproductive tract; hormonal disturbances, nutritional deficiency, infectious pathological immunological causes of infertility; physiopathology of genitalia; coital injuries and vices of the male, pathological and functional disturbances of the male genital organs; diagnosis and treatment of infertility in male animals; genital surgery of male animals.

VGO 711 Reproductive Endocrinology (2+1)

Endocrinology, reproductive hormones and its classification; regulation of hormone secretion; hypothalamus, anterior and posterior pituitory hormones, puberty, estrous cycle; testicular, ovarian and other reproductive hormones; coitus, oogenesis, ovulation, fertilization, transport of gametes, hormones of pregnancy, parturition and lactation.

VGO 712 Advanced Obstetrics II (2+1)

Detailed studies of various obstetrical operations; caesarean section in domestic animals; ovariohysterectomy in small animals; ovariectomy per vagina and the flank method.

VGO 713 Techniques in Andrology and Gynaecology (2+1)

Laparoscopy in small and large farm animals; ultrasonic technique and its uses in animal gynaecology; vaginal cytological techniques; amniocentasis; evaluation of testicular biopsy; in vitro sperm viability tests and ‘capacitiation of spermatozoa In vitro fertilization; super-ovulation; factors influencing super ovulation; techniques of ova collection; factors influencing quality of ova/embryos; methods of assessing embryo viability; short-term maintenance and culture of embryos; embryo cryopreservation; disease transmission aspects; mircromanipulation of embryos splitting and sexing; transfer of embryos- surgical and non-surgical; embryo transfer and infertility management; induction of twinning.

GUIDELINES FOR THESIS/DISSERTATION PREPARATION

1. Language

English

2. Paper Specifications

Color : White
Size : 21 cm x 29.7 cm (A4)
Weight : 80 g m^{-2}

3. Typing

Left margin :	$\geq$ 3.5 cm
Right margin :	$\geq$ 2.0 cm
Top margin :	$\geq$ 3.0 cm
Bottom margin :	$\geq$ 2.5 cm
Spacing :	Double
Side :	Front single
Number of lines :	$\leq$ 25 per page
Font size :	12 (size 10 is smaller than 12)
Font type :	Times New Roman & Nepali Abstract (Preeti)
Font style :	Regular
Font color :	Black
Breaking a word on 2 lines :	Not allowed
Corrections with fluid :	Not allowed
Overwriting :	Not allowed
Crossing out words :	Not allowed
Typing machine :	Computer
Printing quality :	Laser or letter quality
Copies :	High quality photocopy

4. Illustrations and Photographs

- Place within thesis/dissertation text at appropriate places
- Paste the photographs or illustration plates which are printed on special papers
- Type titles at the bottom of the illustration in the font used in the text
- Protect the photographs by butter paper sheet bound into the thesis

5. **Top Cover** (A sample is given in Appendix A)

- Typed in all capital letters, should include
  - Approved thesis/dissertation title typed 7.5 cm below the top margin
  - Full name of the author typed in the middle of the page
  - Year of thesis/dissertation submission typed 5 cm above the bottom margin

- The left binding width should contain
  - Name of the degree, i.e. Master of Science or Doctor of Philosophy
  - Short name of the author followed by a dash mark and year of submission, i.e. R.B. Budhathoki - 1999

6. **Title Page** (A sample is given in Appendix B)

- Title length commonly not longer than 15 words.
- It is the first page under the top cover typed in all capital letters and center justified on each line with the following information
  - Approved thesis title 5 cm below the top of the page
  - Full name of the author typed 8 lines below the title
  - The following contents typed 8 lines below the title:

THESIS / DISSERTATION
SUBMITTED TO THE
TRIBHUVAN UNIVERSITY
INSTITUTE OF AGRICULTURE AND ANIMAL SCIENCE
RAMPUR, CHITWAN, NEPAL

  - Further 3 lines below the following contents should be typed:

IN PARTIAL FULFILMENT OF THE
REQUIREMENTS FOR THE
DEGREE OF

  - Further 3 line below the following contents should be typed:

(name of the degree)
(major subject within parentheses)

  - Month and year of final copy of thesis/dissertation submission should be given at the bottom line

7. **Certificates**

  - Each thesis/dissertation submitted for evaluation will have two certificates
  - Certificate from the Chairman of the Advisory Committee (Appendix C)
  - Certificate from the Advisory Committee (Appendix D)

8. Acknowledgements

- A short acknowledgement sheet should be next to the inner title sheet
- It should acknowledge contributions of the all concerned including financial sponsors, if any.

9. Table of Contents

- Should include the chapter headings and also the subtitles, if any, with appropriate page references.
- Should be placed next to the certificate sheets.
- The text of the thesis/dissertation should usually consist of the following chapters:
  - Introduction
  - Literature Review
  - Materials and Methods
  - Results
  - Discussion or Results and Discussion
  - Summary and Conclusion
  - Literature Cited
  - Appendices
  - Biographical Sketch (A brief statement giving bio-data of the student)

- Certain chapters, such as introduction and literature review, or results and discussion, may be combined if considered appropriate by the student's advisory committee.
- Each of the above main chapters may have sub-titles.
- At the time of submission, each page of the thesis/dissertation should have a page number in pencil, however, permanent page number will be given in finally bound copies.

10. Literature Cited (A sample is given in Appendix E)

- Standard style of quoting references should be used in the text and under the heading "Literature cited".
- The references should be arranged strictly alphabetically and numbered serially.
- Different sources and types of publications should be given as follows.
  - ***Journal Article***: Name(s) of author(s). Year of publication of the article. Full name of the Journal, volume no. and pages.
  - ***Simple Book***: Name(s) of author(s). Year of publication. Title of the book. Volume number (in case of multivolume book), edition no. (if it is later than the first edition). Place of publication, Publisher's name. Pagination (when a particular page of the book is cited then 'p' should be mentioned before page number cited; 'p' following the page number means total number of pages contained in the document).
  - ***Contribution to Composite Book***: Name(s) of author(s). Year of publication. Title of contribution. Connecting word '*In*:' and following items of information of the source document:

- Name(s) of author(s). Title of the book. Volume no. (in case of multivolume book), edition no. (if it is later than the first edition). Place of publication, Publisher's name. Pagination ('pp' should be used before writing plural pages, i.e. from page to page).

- ***Conference/Workshop/Symposium/Seminar Proceedings***: Name of the Conference, etc., Place, Date of Conference etc., Year of Publication. Title of the publication. Name(s) of editor(s). Year of Publication. Title of the publication. Date of Conference. Place of publication, Publisher's name. Pagination (when a particular page of the book is cited then 'p' should be mentioned before page number cited; 'p' following the page number means total number of pages contained in the document).
- ***Contribution to Conference/Workshop/Symposium/Seminar Proceedings***: Name(s) of author(s). Year of publication. Title of contribution. Connecting word '*In*:' and following items of information of the source document: Name(s) of editor(s). Title of the publication. Name of the Conference. Place and date of the conference. Place of publication, Publisher's name. Pagination (pp' should be used before writing plural pages, i.e. from page to page).
- ***Thesis/dissertation***: Name of the author. Year of submission. Title of the thesis/dissertation. Name of the degree followed by the word Thesis.. Name of the university, Place, Pagination (when a particular page of the thesis/dissertation is cited then 'p' should be mentioned before page number cited; 'p' following the page number means total number of pages contained in the thesis).
- ***Institution/Society Publications***: Name of the institute/society. Year of publication. Title of publication. Place of publication. Publisher's name. Pagination (when a particular page of the publication is cited then 'p' should be mentioned before page number cited; 'p' following the page number means total number of pages contained in the document).
- ***Government Publications***: Name of the Government. Name of the ministry. Name of the department, Section. Year of publication. Title of publication. Place of publication. Publisher's name. Pagination (when a particular page of the publication is cited then 'p' should be mentioned before page number cited; 'p' following the page number means total number of pages contained in the document).

- When quoting references in the text of the thesis, the last names of the authors for up to two authors, and last name of the first author *et al*. for more than two authors should be given followed by the year of publication within parentheses. When reference made to more than one publication by the author(s) in the same year, the publication should be numbered as (a) and (b) of that year with the earliest publication the year being designated (a) and so on.

- In case of doubts, the students may consult their advisors or office of the Postgraduate Program.

11. Submission of Thesis/Dissertation

- Thesis/dissertation can be submitted during office hours on any day of the semester a student is registered for. Failing to do so will require the student to register and pay all fees for another semester.
- Four unbounded copies of the thesis should be submitted to the Postgraduate Program Office. One copy will be retained in the Postgraduate Program Office, one sent each to the Dean, the Head of the major department, and to the Division of Examination Control.

12. Abstract (A sample is given in Appendix F)

- All students, in addition to thesis/dissertation, must also submit 8 copies of the abstract, both in English and in Nepali (Nepali title and Committee members), of about 300 words typed single-spaced on white bond paper (21 cm x 29.7 cm). The Chairman of the student's Advisory Committee must have signed each copy of the abstract submitted.

13. Thesis/Dissertation Evaluation and Viva-voce (A copy of the Performa is given in Appendix G/H)

- The thesis/dissertation evaluation will be jointly done by the members of the student's Advisory Committee, head of the major department, Assistant Dean, Postgraduate Program, and the Dean. Besides, any other faculty member may be present as visitor(s).
- For the thesis defense/dissertation examination, four copies of the manuscripts in the prescribed performa should be submitted to the Postgraduate Program. A copy is sent each to the Major Advisor, the Head of the major department, the Division of Examination Control. And one retained in the PG Program Office.
- It is the student's responsibility to request and get thesis evaluation completed. The members of the student's Advisory Committee and other related officials will conduct the examination and prepare the results.
- A student passes this evaluation on the basis of decision of the majority of the Advisory Committee members.

14. Final Submission of Thesis/Dissertation

- The final copy of the thesis/dissertation must contain the following information in the order given below.
    1. Cover Page (M.Sc. hard bound green and PhD hard bound black color)
    2. Title Page
    3. Certificate (Appendix C)
    4. Thesis/Dissertation Acceptance Form (Appendix – I/J)
    5. Acknowledgements
    6. Table of Contents
    7. List of Tables
    8. List of Figures (if any)
    9. List of Appendices (if any)
    10. Abstract in English
    11. Abstract in Nepali
    12. Text of the thesis (Introduction, Literature Review, Materials and Methods, Results and Discussion, Literature Cited, Appendices)

13. Biographical Sketch

- No page number should be shown on the title page and thesis acceptance form but it should be counted.
- Page numbering should start from acknowledgements in Greek numerals with acknowledgements page numbered 'iii' at the bottom in the middle. Greek numbering this way should continue till abstract page. Arabic numerals should start from the page containing Introduction near the upper right corner of the page. The pages containing individual chapter titles, such as Introduction, Literature Review, Materials and Methods, etc., should be counted but should not be numbered.
- M.Sc. thesis will be bound in bottle green hard cover whereas Ph.D. dissertation in dark black with golden letters.
- Corrections and modifications suggested during Thesis/Dissertation Evaluation and Viva-voce must be properly incorporated.
- Three hard bound copies should be submitted to the Postgraduate Program Office after successful completion of the viva-voce along with correction certification from the Major Advisor.
- The student will also have to submit the clearance form from the Institute along with final submission of thesis/dissertation.

Note: Assistant Dean of the Postgraduate Program may approve minor modifications in these guidelines in specific cases on the recommendation of the Advisory Committee.

APPENDIX – A (Sample of the Top Cover)

BEHAVIOR AND MANAGEMENT OF WILD AND DOMESTICATED HONEYBEES (*Apis* spp.) IN CHITWAN, NEPAL

SUROJ POKHREL

JULY 2005

APPENDIX – B (Sample of the Title Page)

BEHAVIOR AND MANAGEMENT OF WILD HONEYBEES (*Apis* spp.) IN CHITWAN, NEPAL

SUROJ POKHREL

DISSERTATION
SUBMITTED TO THE
TRIBHUVAN UNIVERSITY
INSTITUTE OF AGRICULTURE AND ANIMAL SCIENCE
RAMPUR, CHITWAN, NEPAL

IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE
DEGREE OF

DOCTOR OF PHILOSOPHY (PhD) IN AGRICULTURE
(ENTOMOLOGY)

JULY 2005

APPENDIX – C (Format of the Certificate)

CERTIFICATE

This is to certify that the thesis/dissertation entitled "_____" submitted in partial fulfillment of the requirements for the degree of _____ with major in _____ and minor in _____ of the Postgraduate Program, Institute of Agriculture and Animal Sciences, Rampur, is a record of original research carried out by Mr./Ms. _____ Id. No. _____, under my supervision, and no part of the thesis/dissertation has been submitted for any other degree or diploma.

The assistance and help received during the course of this investigation have been acknowledged.

_____

(Name)
Chairman of the Advisory Committee
(Name of the Major Department)
Date:

APPENDIX – D (Certificate for draft)

CERTIFICATE

We, the undersigned, members of the Advisory Committee of Mr./Ms. _____ Id. No. _____, a candidate for the degree of _____ with major in _____ and minor in _____ agree that the thesis entitled " _____ _____ " may be submitted in partial fulfillment of the requirements for the degree.

_____	_____	_____
(Name)	(Name)	(Name)
Chairman	Member	Member
Advisory Committee	Advisory Committee	Advisory Committee
Date:	Date:	Date:

APPENDIX – E (Samples of Referencing)

CITATIONS

A. Journal Article

1. Thapa, R. B. 2006. Honeybee and other insect pollinators of cultivated plants: A review. J. Inst. Agric. Anim. Sci. 27: 1-23.
2. Thapa, R. B. and S. Pokhrel. 2007. An inventory of bee flora in Chitwan, Nepal. IAAS Res.Adv. 2:133-139.

B. Book/Manual

1. Shrestha, G. K., D. R. Baral, S. M. Shakya and D. M. Gautam. 1993. Fundamentals of horticulture. IAAS, Rampur, Chitwan, Nepal. 226 p.
2. Steel, R.G.D. and J.H. Torrie. 1980. Principles and procedures of statistics (2^{nd} ed). McGraw-Hill Book Co., New York, USA. 633 p.
3. Tiwari, S. and R. B. Thapa. 2010. Laboratory manual of economic entomology. Tribhuvan University, Department of Entomology, Institute of Agriculture and Animal Science, Rampur, Chitwan, Nepal. 111p.

C. Contribution to Composite Book

1. Dubin, H. J. and M. van Ginkel. 1991. The status of wheat diseases and disease research in warmer areas. *In*: D. A. Saunders (ed.) Wheat for the Non-traditional Warm Areas. CIMMYT, Mexico, D.F. pp. 125-145.

D. Conference/Workshop/Symposium/Seminar Proceedings

1. K.W. Riley and N. Mateo. 1987. Proceedings of the mountain agriculture and crop genetic resources. International Workshop on Mountain Agriculture and Crop Genetic Resources, Kathmandu, February 14-19, 1987. Oxford IBH, New Delhi, India. 278 p.
2. Thapa, R. B. (ed.). 2007. Proceedings of the national level information sharing workshop on conservation and management of pollinators for sustainable agriculture through an ecosystem approach, jointly organized by IAAS/ MOAC/ FAO, 18-19 July 2007. Institute of Agriculture and animal Sciences, Rampur, Chitwan, Nepal. 79 p.

E. Contribution to Conference/Workshop/Symposium/Seminar Proceedings

1. Thapa, R. B. 2003. Pesticide pollution and integrated pest management. *In*: F. P. Neupane (ed.) Proceedings of the National Seminar on Integrated Pest Management in Nepal, 25-26 Sept. 2002. HIRI/Care Nepal/ FAO, Kathmandu, Nepal. pp. 175-194.
2. Tung, D. 1973. Recent advances in numerical analysis of structural eigen value problems. *In*: Proceedings of Theory and Practice in Finite Structural Analysis. Tokyo Seminar on Finite Element Analysis, November 5-7, 1973. University of Tokyo, Japan. pp. 247-171.

F. Thesis/Dissertation

1. Thapa, R. B. 1982. Cultural, biological and chemical control of *Pieris rapae* (L.) on cabbage and cauliflower. M.S. Thesis, MSU, USA. 70 p.

2. Pokhrel, S. 2005. Behavior and management of domesticated and wild honeybees (*Apis* spp.) in Chitwan, Nepal. Ph.D. Dissertation. Tribhuvan University, Department of Entomology, IAAS, Rampur, Chitwan, Nepal. 267p.

G. Government /Institution Publication

1. IAAS. 1997. IAAS Bulletin. Rampur, Chitwan, Nepal. 155 p.
2. MOAC. 1992. Agricultural Development Plans. Sajha Publications, Kathmandu, Nepal. 150 p.
3. NGLRP. 2005. Annual Report. National Grain Legumes Research Program (NGLRP). Nepal Agricultural Research Council, Rampur, Chitwan, Nepal. 20p.

H. Abstracts

1. Thapa, R.B. and M.D. Sharma. 2006. Abstracts of postgraduate theses/ dissertations (2000-2006). Institute of Agriculture and Animal Sciences (IAAS), Rampur, Chitwan, Nepal. 132 p.
2. Thapa, R.B. and M.D. Sharma. 2006. Abstracts of IAAS Journal (1977-2005). Institute of Agriculture and Animal Sciences, Rampur, Chitwan, Nepal. 123 p.

I. Magazine Article

1. Devkota, D. 2001. Women and their role in development. Business Women July 12:30-45.

J. Bulletin

2. Ghimire, A.J., F.S. Howlett and E.H. Emment. 2001. Factors affecting apple hardness and methods of measuring resistance of tissue to low temperature injury. Ohio Agric. Expt. Sta. Res. Bull. 901

K. Newsletter

1. Armes, N. J. and R. Pandey. 1995. Pyrethroid resistance in *Helicoverpa armigera* in Nepal. Resistant Pest Management Newsletter 7 (1): 11-12.

L. Research Report

1. Thapa, R.B. and Y.D. GC. 2000. Integrated management of soil insect pests in the mid hill of Nepal. SSMP documents No. 44. 61p.

M. Working Paper

1. Pandey, R.R., T.B. Gurung, Y.D. GC, and G. Gurung, 1997. Monitoring and management of tomato fruitworm (*Helicoverpa armigera*) and its egg parasite (*Trichogramma chilonis* Ishi.) in western hills. Lumle Agricultural Research Centre (LARC), Kaski. Working Paper No. 24.

N. Research Report

1. Thapa, R.B. and Y.D. GC. 2000. Integrated management of soil insect pests in the mid hill of Nepal. SSMP documents No. 44. 61p.

O. Electronic Source

1. Locker, K.O. 2001. The history of the association of business. Association for Business Communication Website: http://www.theabc.org/history.html (Retrieved on April 21, 2002).
2. CABI. 2005. Crop protection compendium. CAB International, Wallingford, OX10 BDE, UK.

APPENDIX –F (Format for Abstract)

ABSTRACT

Name: Id. No.:
Semester and year of admission: Degree:
Major Subject: Department:
Major Advisor:

_____ _____

(Name) (Name)
Major Advisor Author

APPENDIX – G (MSc)

INSTITUTE OF AGRICULTURE AND ANIMAL SCIENCES
POSTGRADUATE PROGRAM
FORM FOR THESIS AND VIVA-VOCE REPORT
(to be filled in quadruplicate)

The Viva-voce examination of Mr./Ms. _____ Id. No. _____, a candidate for the degree of _____ with major in _____ was conducted by the undersigned on _____ at _____ and our decision on the student's performance on viva-voce examination and evaluation of the thesis entitled _____ is given below.

Signatures of	Performance of the student
Major Advisor _____	Satisfactory / Unsatisfactory*
Member _____	Satisfactory / Unsatisfactory*
Member _____	Satisfactory / Unsatisfactory*

Head of Department _____

Forwarded for Approval: Approved:

Asst. Dean, PGP _____ Dean, IAAS _____

*Strike off which is not applicable. Cuttings must be signed by the Major Advisor with date.

A copy of the above along with report card forwarded to the:

I. Division of Examination Control
II. Major Advisor
III. Academics

APPENDIX – H (PhD)

INSTITUTE OF AGRICULTURE AND ANIMAL SCIENCES

POSTGRADUATE PROGRAM

FORM FOR DISSERTATION AND VIVA-VOCE REPORT

(to be filled in quadruplicate)

The Viva-voce examination of Mr./Ms. _____ Id. No. _____, a candidate for the degree of _____ with major in _____ and minor in _____ was conducted by the undersigned on _____ at _____ and our decision on the student's performance on viva-voce examination and evaluation of the dissertation entitled " _____ _____ " is given below.

Signatures of	Performance of the student
Major Advisor _____	Satisfactory / Unsatisfactory*
Member _____	Satisfactory / Unsatisfactory*
Member _____	Satisfactory / Unsatisfactory*
Member _____	Satisfactory / Unsatisfactory*

Director of Research _____

Forwarded for Approval: Approved:

Asst. Dean, PGP _____ Dean, IAAS _____

*Strike off which is not applicable. Cuttings must be signed by the Major Advisor with date.

A copy of the above along with report card forwarded to the:

P. Division of Examination Control

II. Major Advisor

III. Academics

APPENDIX – I (Final Thesis/Dissertation Acceptance Form)

The thesis attached hereto, entitled ("Title of the thesis in capital letters") prepared and submitted by (full name of the author in capital letters), in partial fulfillment of the requirements for the degree of (name of the degree), is here by accepted.

Signature
(Name)
Member, Advisory Committee
Date:

Signature
(Name)
Member, Advisory Committee
Date:

Signature
(Name)
Chairman, Advisory Committee
Date:

Accepted as partial fulfillment of the requirements for the degree of (name of the degree).

Signature
(Name)
Assistant Dean (Academics)
Postgraduate Program
Date:

Signature
(Name)
Dean
Institute of Agriculture and Animal Science
Date:

Ready Made Sample (PhD)

APPENDIX-A

BEHAVIOR AND MANAGEMENT OF WILD AND DOMESTICATED HONEYBEES (*Apis* spp.) IN CHITWAN, NEPAL

SUROJ POKHREL

JULY 2005

APPENDIX-B

BEHAVIOR AND MANAGEMENT OF WILD HONEYBEES (*Apis* spp.) IN CHITWAN, NEPAL

SUROJ POKHREL

DISSERTATION
SUBMITTED TO THE
TRIBHUVAN UNIVERSITY
INSTITUTE OF AGRICULTURE AND ANIMAL SCIENCE
RAMPUR, CHITWAN, NEPAL

IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE
DEGREE OF

DOCTOR OF PHILOSOPHY (PhD) IN AGRICULTURE
(ENTOMOLOGY)

JULY 2005

APPENDIX-C

CERTIFICATE

This is to certify that the dissertation entitled **"BEHAVIOR AND MANAGEMENT OF WILD AND DOMESTICATED HONEYBEES (*Apis* spp.) IN CHITWAN, NEPAL"** submitted in partial fulfillment of the requirements for the degree of **DOCTOR OF PHILOSOPHY (PhD)** with major in **ENTOMOLOGY** and minor in **PLANT PATHOLOGY** of the Postgraduate Program, Institute of Agriculture and Animal Science, Rampur, is a record of original research carried out by **Mr. SUROJ POKHREL** Id. No **R-2003-ENT-01P**, under my supervision, and no part of the dissertation has been submitted for any other degree or diploma.

The assistance and help received during the course of this investigation have been acknowledged.

Prof. Resham B. Thapa, PhD
Chairman of the Advisory Committee
Date:

APPENDIX-D

CERTIFICATE

We, the undersigned, members of the Advisory Committee of **Mr. SUROJ POKHREL** Id. No **R-2003-ENT-01P**, a candidate for the degree of **DOCTOR OF PHILOSOPHY (PhD)** with major in **ENTOMOLOGY** and minor in **PLANT PATHOLOGY** agree that the dissertation entitled **"BEHAVIOR AND MANAGEMENT OF WILD HONEYBEES (*Apis* spp.) IN CHITWAN, NEPAL"** may be submitted in partial fulfillment of the requirements for the degree.

---	---	---
Prof. Resham B. Thapa,PhD	Prof. Sundar M. Shrestha,PhD	Prof. Fanindra P. Neupane,PhD
Chairman	Member	Member
Advisory Committee	Advisory Committee	Advisory Committee
Date:	Date:	Date:

APPENDIX-E

INSTITUTE OF AGRICULTURE AND ANIMAL SCIENCE
POSTGRADUATE PROGRAM
FORM FOR THESIS/DISSERTATION AND VIVA-VOCE REPORT
(to be filled in quadruplicate)

The viva-voce examination of **Mr. Suroj Pokhrel** Id. No. **R-2003-ENT-01P**, a candidate for the degree of **Doctor of Philosophy (PhD)** with major in **Entomology** and minor in **Plant Pathology** was conducted by the undersigned on _____ at **IAAS, Rampur, Chitwan** and our decision on the student's performance on viva-voce examination and evaluation of the thesis entitled **"Behavior and management of wild honeybees (*Apis* spp.) in Chitwan, Nepal"** is given below.

Signatures of	Performance of the student
Major Advisor _____	Satisfactory / Unsatisfactory*
Member _____	Satisfactory / Unsatisfactory*
Member _____	Satisfactory / Unsatisfactory*
Member _____	Satisfactory / Unsatisfactory*
Director of Research _____	
Countersigned	Countersigned
Asst. Dean. PGP _____	Dean, IAAS _____

*Strike off which is not applicable Cuttings must be signed by the Major Advisor with date

A copy of the above along with report card forwarded to the

I. Division of Examination Control
II. Major Advisor
III. Academics

APPENDIX-F

The dissertation attached hereto, entitled **"BEHAVIOR AND MANAGEMENT OF WILD HONEYBEES (*Apis* spp.) IN CHITWAN, NEPAL"** prepared and submitted by **Mr. SUROJ POKHREL** in partial fulfillment of the requirements for the degree of **DOCTOR OF PHILOSOPHY (PhD)** in Agriculture is hereby accepted.

Name: Prof. S. M. Shrestha, PhD
Member, Advisory Committee
Date:

Name: Prof. F. P. Neupane, PhD
Member, Advisory Committee
Date:

Prof. Resham B. Thapa, PhD
Chairman, Advisory Committee
Date:

Accepted as partial fulfillment of the requirements for the degree of **DOCTOR OF PHILOSOPHY (PhD)** in Agriculture

---
Prof. Sundar M. Shrestha, PhD
Assistant Dean (Academics)
Postgraduate Program
Date:

Prof. Durga D. Dhakal, PhD
Dean
Institute of Agriculture and Animal Science
Date:

APPENDIX-G

TRIBHUVAN UNIVERSITY

INSTITUTE OF AGRICULTURE AND ANIMAL SCIENCE
POSTGRADUATE PROGRAM

FORM FOR EVALUATION ON THE PROGRESS OF THE PHD STUDENT (PLAN-B)

The PhD Committee meeting was held on the Chairmanship of the Dean to evaluate progress of the student.

Progress of the PhD Student

Name and ID No:

The Major Advisor briefed on the progress of the student after his/her presentation and discussion was held in the committee. The student's research activities were found satisfactory and on the recommendation of the Major Advisor the committee approved the satisfactory completion in this Semester.

_____

(Name)

Major Advisor

_____	_____	_____
(Name)	(Name)	(Name)
Director of Research	Asst. Dean (Academics)	Dean
Date:	Date:	Date: