

PONDICHERRY UNIVERSITY

PUDUCHERRY 605 014



M.V.Sc. DEGREE PROGRAMME

(Master of Veterinary Science)

Revised Syllabi & Regulations

2016-17 ONWARDS



PONDICHERRY UNIVERSITY

PUDUCHERRY 605 014.

M.V.Sc. Degree Programme

Revised Syllabi & Regulations

(2016-17 onwards)

1. Short title, application and commencement:

- 1.1 These regulations may be called as Post-graduate Studies in M.V.Sc. Degree regulations 2016.
- 1.2 They shall govern the Post-graduate studies leading to the award of Degree of Master of Veterinary Science by Pondicherry University.
- 1.3 They shall come into force with effect from the academic year 2016-17

2. Definitions:

In these regulations, unless the context otherwise requires

- 2.1 **Academic year:** A period consisting of two consecutive semesters including inter-semester break as announced by the College.
- 2.2 **Semester:** An academic term consisting of not less than 110 instructional days excluding the days of external examinations.
- 2.3 **Credit hour, Semester Credit or Credit:** One hour of lecture or three hours of laboratory or field practicals or hospital each week in a semester.
- 2.4 **Course:** A unit of instruction or segment of subject matter (as specified in the course catalogue) to be covered in a semester, having a specific number and credits.

- 2.5 Course Catalogue:** A list of approved courses for the M.V.Sc. degree programme wherein each course is identified with a specific number and credits giving outlines of syllabus.
- 2.6 Grade Point (GP) of a course:** The value obtained by dividing the percentage of marks earned in a course by 10 and the grade point expressed on a 10-point scale up to one decimal place.
- 2.7 Credit Point of a course:** The product of grade point and credit hours in a course.
- 2.8 Grade Point Average (GPA):** The quotient of the total credit points obtained by a student in various courses at the end of each semester divided by total credit hours completed by the student in that semester. The Non Credit and Research Credits are not to be included for the calculation of GPA. The GPA shall be corrected to second decimal place.
- 2.9 Overall Grade Point Average (OGPA):** The quotient of cumulative credit points obtained by a student in all courses completed by a student from the beginning of the first semester of the P.G. degree course divided by completed credit hours up to the end of a specified semester and it determines the overall performance of a student in all the courses taken during the period covering more than one semester. The Non Credit and Research Credits are not to be included for the calculation of OGPA. The OGPA has to be corrected to second decimal place.

3. Academic Departments referred to in this regulations:

1. Veterinary Anatomy
2. Veterinary Physiology
3. Veterinary Biochemistry
4. Veterinary Pharmacology and Toxicology
5. Veterinary Microbiology
6. Veterinary Parasitology
7. Veterinary Pathology
8. Veterinary Public Health & Epidemiology
9. Animal Genetics and Breeding

10. Animal Nutrition
11. Livestock Production and Management
12. Livestock Products and Technology
13. Veterinary Gynaecology & Obstetrics
14. Veterinary Medicine
15. Veterinary Surgery and Radiology
16. Veterinary and Animal Husbandry Extension Education

4. Major Fields of study for M.V.Sc. degree:

1. Veterinary Anatomy
2. Veterinary Physiology
3. Veterinary Biochemistry
4. Veterinary Pharmacology and Toxicology
5. Veterinary Microbiology
6. Veterinary Parasitology
7. Veterinary Pathology
8. Veterinary Public Health
9. Animal Genetics and Breeding
10. Animal Nutrition
11. Livestock Production and Management
12. Livestock Products and Technology
13. Veterinary Gynaecology & Obstetrics
14. Veterinary Medicine
15. Veterinary Surgery and Radiology
16. Veterinary and Animal Husbandry Extension Education

5. Admission Procedure:

5.1 Eligibility for admission: The candidate seeking admission to Postgraduate programme leading to M.V.Sc. Degree shall possess

- (i) B.V.Sc. / B.V.Sc. & A.H. degree from an Institution recognized by Veterinary Council of India (VCI) with a

minimum OGPA of 6.0 in 10 point scale (5.0 for SC/ST candidates). In the other grading systems, OGPA / marks will be appropriately proportioned to the 10 point grading scale.

(ii) Shall secure a minimum of 50% in the entrance examination (40% for SC/ST candidates of UT of Puducherry).

5.2. Selection: The Selection of candidates will be based both on marks obtained in the B.V.Sc./B.V.Sc. & A.H. examination and the entrance examination with equal weightage (50% each).

5.3. Entrance Examination: An entrance examination will be conducted by RIVER, Pondicherry on a date and time to be notified. The syllabus for entrance examination will be the syllabus prescribed by the VCI for B.V.Sc. & A.H. Degree. The details of entrance examination will be furnished in the information bulletin for admission.

5.4. Registration of courses: The candidates provisionally selected for admission have to pay the prescribed fee and deposit all the original certificates and transcripts at the time of admission and register for courses in the prescribed format on the date specified for the purpose. For specific purpose and requirement, students may get their originals from the institutions by applying through proper channel and return the documents by the specified time. Failure to pay the required fee and register the courses will result in the cancellation of his/her offer of admission.

6. Courses and Credits: The M.V.Sc. programme shall have duration of minimum four semesters (two academic years).

6.1. Minimum Credit requirements for Master's Degree:

i) Course work

Major subject	: 28 credits
Minor & Supporting subject (s) (Minimum of 6 credits for Minor & 3 credits for supporting subjects)	: 11 credits
Seminar (Major subject)	: 01 credit
Non credit compulsory courses	: Nil credit

ii) Research Work : 20 credits

Total : **60 credits**

Major subject: The subject (department/discipline) in which a student takes admission.

Minor subject: The subject closely related to a major subject (as per the list specified for each major subject)

Supporting subject: The subject not related to major subject. It could be any subject considered to be relevant for student's research work or necessary for building overall competence.

Non credit compulsory courses: Four courses are of general nature under compulsory for master's programme.

Course code	Course title	Credits
PGS-501	Library and information services	0 +1
PGS-502	Technical writing and communication skills	0 +1
PGS-503 (e- course)	Intellectual Property and its management in Veterinary/ Agriculture	1+0
PGS-506 (e- course)	Disaster Management	1+0

6.2. Credit load: A candidate shall be allowed to register for a maximum of 18 credits excluding non credit courses in a semester. However, to an extent of 2 credits more than the prescribed maximum can be registered in a semester with prior approval of the Dean.

6.3. Residential requirements: Minimum residential requirement for M.V.Sc. degree programme is four semesters (two academic years) and the maximum limit for completion of M.V.Sc. programme is eight semester i.e. four academic years (inclusive of duration of discontinuation, if any). If a student fails to complete his/her Master's programme with in the maximum time limit prescribed, his/her admission shall stand cancelled.

7. Attendance: The student is required to have an attendance of at least 85 % of total classes separately for theory and practical in each course. If any student falls short of the required attendance the Dean may condone a shortage of up to 10% of attendance on valid grounds. If any student falls short of the required attendance he/she will not be permitted to appear in the University examinations and such candidates are required to re-register the course (s) in which he or she had fallen short of the required attendance.

8. Evaluation and Examinations:

Evaluation of a student in each course is based on Internal (50%), external (50%) for theory and practical. The weightage between theory and practical shall be as per the credits of the course.

8.1 Internal Examinations: It shall be the responsibility of the concerned Dean / Head of the Department to ensure proper conduct of all internal evaluations in all the courses offered by that Department. The internal marks scored by the student will be communicated by the Dean at the end of the semester to the Pondicherry University for the declaration of the result.

8.1.1. The theory internal examination consists of one midterm examination for 30 marks, seminar or assignment for 20 marks.

8.1.2. The internal practical examination shall be conducted at the end of the semester for 100 marks comprising of 70 marks for practical, 20 marks for practical assignments / record and 10 marks for viva-voce. Submission of records / assignments and attendance in viva-voce examination are compulsory.

8.1.3. The answer scripts of all the internal examinations will be shown to the students after evaluation. The concerned HOD will retain the answer scripts for a minimum period of two years after the student completes the degree programme.

8.2. External Examinations: The external examination in each course will be conducted in theory after the end of the semester and the external examiner will evaluate the theory papers for all the courses offered by one department including major and minor fields of study. The external examination for each course in theory will consist of one paper for 100 marks comprising subjective questions for 3-hour duration. The external practical examination for 100 marks (80 marks for practical, 10 marks for records and 10 marks for viva-voce) will be conducted with one internal and one external examiner nominated by the Controller of Examinations, Pondicherry University.

8.3. Comprehensive Examination: The comprehensive examination should be conducted after the completion of 75% of the course work in major subject (proportionately covering those courses) by obtaining the question paper from an external examiner by the

Pondicherry University. The comprehensive written examination in major subject will be for 100 marks comprising subjective questions for 3-hour duration. The answer scripts will be evaluated internally and reported to the University. A student must get at least 60 % of marks in the written comprehensive examination and will be graded as Satisfactory/Unsatisfactory. In case a student fails to get satisfactory result he or she may be asked to reappear for the comprehensive examination one month after the declaration of the result. It shall be the responsibility of the Head of the Department to ensure proper conduct of comprehensive examination for all the students in the concerned Department.

9. **External Examiners:** All the Professors, Associate Professors and those Assistant Professors who possess Ph.D. Degree with five years of Teaching/Research/Extension experience in the concerned field of specialization and working in veterinary colleges and academic institutions are eligible for appointment as external examiners including thesis evaluation and paper setters. The retired experts with above criteria below the age of 65 years can also be appointed as external examiners.

- 9.1. **Panel of examiners:** The HOD will submit a panel of five external examiners to the University through the Dean of the college for conducting the Semester Theory and Practical External Examinations including the paper setters for the Comprehensive Examination in the concerned subject.

- 9.2. **Evaluation:** The Semester External Examination answer scripts will be evaluated by the External Expert. All the answer scripts of the internal examinations (including the Comprehensive Examination) will be evaluated internally. All these internal evaluations will involve HOD and the course in-charge for the individual courses / the Chairman of the Advisory Committee for the Comprehensive Examination.

10. **Minimum Marks for Pass :** If a candidate fails in any course in aggregate of theory and practical with GP of less than 6.00, he/she should reappear for all the examinations in theory and practical (internal and external) in that course conducted in the ensuing semester. The Pondicherry University will declare the results of the examinations and the results will be communicated to the college.

- 11. Advisory Committee:** The HOD shall allot a major advisor / Chairman advisory committee for each student registered for M.V.Sc. programme in his/ her department in the first semester. The major advisor in consultation with the HOD will propose an advisory committee for approval by the Dean in the second semester. The committee shall consist of at least three members two from the major field of study and one from the minor field. ‘

The following teachers are eligible to be appointed as **Chairman** of the Student Advisory committee:

- i. Professors and Associate Professors
- ii. Assistant Professors who possess Ph.D. Degree with five years of Teaching/Research/Extension experience in the concerned field of specialization
- iii. Assistant Professors who do not possess Ph.D. Degree but have eight years of Teaching/Research/Extension experience in the concerned field of specialization.

However, Assistant Professors who do not possess Ph.D. Degree but have at least five years of experience in Teaching/Research/Extension in the concerned field of specialization are also eligible to be appointed as **members of the advisory committee.**

- 11.1. Changes in Advisory committee:** If the Chairman / any member of the advisory committee is not available for any reason or proceeds on long leave / resigns / retires from the present assignment, the HOD may recommend an eligible substitute for approval by the Dean. However, in such cases, if the concerned student is likely to submit his or her thesis within 90 working days, the same Chairman/ member(s) may be permitted to continue to guide the student.

12. Research Project formulation and Supervision:

On successful completion of 75% of the Course work in the Major Subject, the student can register eligible research credits in the subsequent semester. The Chairman in consultation with the members of the advisory committee shall identify the topic of research project and submit the Synopsis of the proposed Research Project in prescribed format to the Dean for approval. He/she will also present a seminar on the proposed work to the faculty of the college including the members of the Research Advisory Committee (RAC) of the college. Based on the recommendations of the RAC the Dean will accord the approval to the

synopsis. Subsequent change(s) if any in the synopsis need to be approved by the Dean on the recommendation of the RAC. The student will carry out the research work as per the approved synopsis under the supervision and guidance of the Advisory Committee.

12.1. Approval of the synopsis: The synopsis approval must be accomplished in the semester in which the registration of the research credits started. The time between submission of synopsis and thesis shall be at least one semester.

13. Preparation and submission of thesis:

On successful completion of the research credits and research work to the satisfaction of the advisory committee, the candidate will present a seminar on the research work before the faculty members. After incorporating the necessary suggestions in consultation with the Advisory Committee, the candidate will submit three draft copies of the thesis and the approved synopsis to the Dean along with a certificate in the prescribed proforma duly signed by the advisory committee. Three copies of thesis abstract of not more than 300 words shall also be submitted along with the thesis. The student is permitted to submit his or her thesis within 30 calendar days after the closure of the semester failing which he/she has to register in the concerned semester by paying a registration fee of Rs. 5000/- with 0 credits. If he/she fails to submit the thesis in that semester too, the student has to register in the subsequent semester by paying the balance amount of the Annual fee with 0 credits.

14. Evaluation of the thesis:

The Head of the Department in consultation with the Chairman of the Advisory committee shall submit a panel of five external examiners in the field of specialization to the Dean for forwarding to the University. The thesis will be sent to one of the examiner from the panel who shall be required to send the detailed evaluation report with specific recommendation in a prescribed proforma to the University within the stipulated time.

14.1. Recommendation of the Examiner: In case the external examiner recommends for the acceptance of the thesis with remarks as “HIGHLY COMMENDED OR COMMENDED”, the report will be forwarded to the concerned Head of the Department for conduct of the Vive voce examination. The student shall submit five final bound copies of the thesis after incorporating the

suggested corrections of the external examiner in consultation with the Advisory Committee to the HOD who in turn will arrange for conduct of final viva-voce examination by inviting the external examiner who evaluated the thesis. The viva voce will be conducted by the HOD, external examiner and the members of the Advisory Committee. A certificate regarding the performance of the candidate in final viva-voce examination on the thesis in the prescribed form, duly signed by all the members of the Advisory committee and the external examiner shall be forwarded to the Dean by the concerned HOD. The result of the examination should clearly indicate the performance of the student either as "SATISFACTORY" or "UNSATISFACTORY" and the same will be communicated to the University for the Declaration of the result.

14.1.1. If the performance of the candidate in the viva voce examination is "UNSATISFACTORY", he/she may be asked to take the viva voce examination after a lapse of at least 30 days after the declaration of the result of the final viva voce examination.

14.1.2. If the external examiner does not recommend for the award of the degree with the comments to revise and resubmit the thesis, the concerned HOD in consultation with the members of the Student Advisory Committee may arrange for incorporating the suggestions given by the external examiner and resubmit the thesis to the University to arrange for evaluation by the same examiner.

14.1.3. If the external examiner rejects the thesis, the University may send the thesis to the second examiner from the panel of examiners for evaluation. If the second examiner recommends for the award of the degree, the report will be forwarded to the concerned HOD to arrange for conduct of viva voce examination as per the procedure in 14.1.

14.1.4. In case the second external examiner also rejects the thesis, the candidate will have to re-register the research credits and carry out the research work afresh.

14.2. A candidate shall not be permitted to submit his/her thesis for more than two occasions.

15. Grading & Transcript:

The University will award the grades to the students on a 10-point scale. A grade report/Transcript for each semester will be issued by the University during the subsequent semester. The University will issue a final transcript indicating the courses, credits and OGPA after the successful completion of all the courses and thesis viva voce examination.

- i. Minimum passing grade in a course: 6.00
- ii. Minimum GPA/OGPA to appear for the comprehensive examination, registration of research credits and to obtain degree: 6.50

If a candidate fails to get GPA/OGPA of 6.5, he/she should improve the GP by reappearing for the examination conducted during ensuing semester in not more than two courses of the major subject with the recommendation of the advisory committee.

16. Eligibility for Degree:

A candidate is eligible for the award of M.V.Sc. degree after successful completion of the prescribed courses and research credits including final thesis viva voce examination with minimum OGPA of 6.50. Candidate securing an OGPA of 8.50 and above and completing the courses, Comprehensive examination and final thesis examination satisfactorily in the first attempt will be awarded degree in FIRST CLASS WITH DISTINCTION. Candidate securing an OGPA of 7.50 to 8.49 and completing the courses, Comprehensive examination and final thesis examination satisfactorily in the first attempt will be awarded degree in FIRST CLASS. All the other passed candidates will be placed in SECOND CLASS.

17. Temporary discontinuation and resumption of studies:

If a student wants to discontinue his/her studies temporarily or take a long leave, he/she may do so after successful completion of comprehensive examination with the prior approval of the Pondicherry University. Discontinuation before successful completion of comprehensive examination shall result in cancellation of admission. The discontinuation is allowed only once in the M.V.Sc. degree

programme. However, the maximum time limit prescribed for the completion of Master's Programme shall remain unchanged. The M.V.Sc. student should not be on the active rolls of employment in Government or University or any private or public undertakings during the study period.

18. Amendment or Cancellation of result:

If the result of a candidate is discovered to be vitiated by error, malpractice, fraud, improper conduct or any other reason, the Vice Chancellor shall have the power to amend the result in such a manner as to accord with the true position and to make such a declaration as the Vice Chancellor may deem necessary in that behalf including debarring the candidate from the University/ College.

19. Removal of Difficulties:

19.1. If any difficulty arises in giving effects to provisions of these regulations, Vice-chancellor Pondicherry University may issue necessary orders which appear to the authorities to be necessary or expedient for removing the difficulty.

19.2. No order under Rule 19.1 shall be questioned on the ground that no difficulty as is referred to in the said rule existed or was required to be removed

19.3. Notwithstanding anything contained in the Regulations, Pondicherry University reserves the right to make changes, whenever necessary.

Syllabus

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15.	Veterinary Surgery and Radiology	
16.	Veterinary and Animal Husbandry Extension Education	

1. VETERINARY ANATOMY
Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
VAN 601	COMPARATIVE OSTEOLOGY AND ARTHROLOGY	1+2
VAN 602	COMPARATIVE SPLANCHNOLOGY	2+2
VAN 603	MYOLOGY, ANGIOLOGY, NEUROLOGY AND AESTHESIOLOGY OF OX	1+3
VAN 604	GROSS ANATOMICAL TECHNIQUES	0+2
VAN 605	THEORY AND PRACTICE OF HISTOLOGICAL AND HISTOCHEMICAL TECHNIQUES	1+2
VAN 606	GENERAL HISTOLOGY AND ULTRASTRUCTURE	3+1
VAN 607	SYSTEMIC HISTOLOGY AND ULTRASTRUCTURE	3+1
VAN 608	DEVELOPMENTAL ANATOMY	3+1
VAN 691	MASTER'S SEMINAR	1+0
VAN 699	MASTER'S RESEARCH	20

Major Subject	Minor Subjects*
Veterinary Anatomy and Histology	Veterinary Pathology, Veterinary Surgery and Radiology, Veterinary Physiology, Veterinary Biochemistry

* The choice of minor courses other than those listed above, may be allowed on the recommendations of advisory committee, if essentially required as per the research problem, with the concurrence of Head of the Department and Dean, Post Graduate Studies

VETERINARY ANATOMY

Course Contents

VAN 601 COMPARATIVE OSTEOLOGY AND ARTHROLOGY 1+2

Objective

To make a student well versed with the bones and joints of different domestic animals.

Theory

UNIT I

Technical terms, structure, chemical composition and classification of bones.

UNIT II

Bones of appendicular skeleton of ox as a type and their comparison with those of horse, dog, pig and poultry.

UNIT III

Bones of axial skeleton of ox as a type and their comparison with those of horse, dog, pig and poultry.

UNIT IV

Classification and detailed study of different joints of the body.

UNIT V

Study the various indices for estimating race, sex and age of different animals. Basics of biomechanics of the locomotor system. Radiography of normal and developing bones.

Practical

Demonstration of all bones and dissection of joints of buffalo/Cattle.

Suggested Readings

Dyce KM, Sack WO & Wensing CJG. 1996. *Text Book of Veterinary Anatomy*. WB Saunders.

Nickel R, Schumer A, Seiferle E, Freewin J & Wills KH. 1986. *The Locomotor System of Domestic Mammals*. Verlag Paul Parey.

Sisson S & Grossman JD. 1975. *The Anatomy of the Domestic Animals*. Vols. I, II. WB Saunders.

VAN 602 COMPARATIVE SPLANCHNOLOGY 2+2

Objective

To give a detailed overview of different systems constituting splanchnology.

Theory

UNIT I

Descriptive anatomy of various organs of digestive system and associated glands of ox and their comparison with those of horse, dog, pig and poultry. Study of formation of thoracic, abdominal and pelvic cavities; reflection of these cavities.

UNIT II

Study of various organs/structures and associated glands constituting the respiratory system of ox and their comparison with those of horse, dog, pig and poultry.

UNIT III

Detailed study of organs and associated glands comprising the urinary system of ox as a type and their comparison with those of horse, dog, pig and poultry.

UNIT IV

Complete study of various organs and associated glands of male and female genital systems.

UNIT V

Surgical sites for various operations and clinically significant areas for performing auscultation, percussion and for carrying out surgical procedures such as laryngotomy, oesophagotomy, gastrotomy, rumenotomy, cystotomy, urethrotomy, caesarian section, exploratory laparotomy, mastectomy, thoracotomy, thoracocentesis etc.

Practical

Demonstration of structure and placement of organs in body cavities of all the animals.

Suggested Readings

Dyce KM, Sack WO & Wensing CJG. 1996. *Text Book of Veterinary Anatomy*. WB Saunders.

Schummer A, Nickel R & Sack WO. 1979. *The Viscera of the Domestic Mammals*. Verlag Paul Parey.

Sisson S & Grossman JD. 1975. *The Anatomy of the Domestic Animals*. Vols. I, II. WB Saunders.

VAN 603

MYOLOGY, ANGIOLOGY, NEUROLOGY AND AESTHESIOLOGY OF OX 1+3

Objective

To give a thorough knowledge about the muscles, course of blood vessels and nerves of the body in addition to various organs of circulatory, nervous and sensory systems of ox as a type animal.

Theory

UNIT I

Classification of muscle fibres. Origin, insertion and relations of muscles of different body parts.

UNIT II

Topographic anatomy of the vascular system comprising of heart, arteries, veins and lymphatics.

UNIT III

Study of various components of central nervous system, peripheral nervous system and autonomic nervous system.

UNIT IV

Complete study of the gross anatomy of various sense organs.

UNIT V

Study of different nerve blocks, intravenous sites and enucleation of eye ball.

Practical

Dissection of heart, different vessels, brain, cranial nerves, brachial plexuses and lumbo-sacral plexus. Dissection of eye, ear, hoof and horn of buffalo/cattle.

Suggested Readings

- Dyce KM, Sack WO & Wensing CJG. 1996. *Text Book of Veterinary Anatomy*. WB Saunders.
- Nickel R, Schumer A, Seiferle E, Freewin J & Wills KH. 1986. *The Locomotor System of the Domestic Mammals*. Verlag Paul Parey.
- Schummer A, Wickens H & Vollmerhaus B. 1981. *Circulatory System, Skin and Skin Organs of Domestic Mammals*. Verlag Paul Parey.
- Seiferle E. 1975. *Nervous System, Sensory Organs, Endocrine Glands of Domestic Mammals*. Verlag Paul Parey.
- Sisson S & Grossman JD. 1975. *The Anatomy of the Domestic Animals*. Vols. I, II. WB Saunders.

VAN 604 GROSS ANATOMICAL TECHNIQUES 0+2

Objective

Hands-on training for preparation of gross anatomical specimens.

Practical

Embalming fluids, embalming of animals, maceration and preparation of skeletons. Gross staining of brain sections. Demonstration of sites of ossifications. Preparation of transparent specimens, preparation of casts of various organs, blood vessels and ducts etc.

Suggested Readings

- Luna LG. 1968. *Manual of Histologic Staining Methods of the Armed Forces Institute of Pathology*. McGraw-Hill.
- Tompsett DH & Wakeley SC. 1956. *Anatomical Techniques*. E & W Living Stone.

VAN 605 THEORY AND PRACTICE OF HISTOLOGICAL1+2 AND HISTOCHEMICAL TECHNIQUES

Objective

To give exposure to methods of processing the tissues for research and teaching purposes.

Theory

UNIT I

Preparation of tissues for light microscopy using different fixatives.

UNIT II

Different staining methods for routine light microscopy.

UNIT III

Frozen sectioning techniques and staining methods for enzymes, carbohydrates, lipids, proteins, pigments etc.

UNIT IV

Silver staining techniques for nervous tissue.

Practical

Study of different techniques for collection, fixation and processing of animal tissues; preparation of paraffin and frozen sections; handling and care of microtomes. Demonstration of staining of carbohydrates, lipids, proteins, nucleic acids and enzymes.

Suggested Readings

- Bancroft JD & Stevens A. 1977. *Theory and Practice of Histological Techniques*. Churchill Livingstone.

- Durry RAB & Wallington EA. 1967. *Carleton's Histological Techniques*. Oxford Univ. Press.
- Luna LG. 1968. *Manual of Histologic Staining Methods of the Armed Forces Institute of Pathology*. McGraw-Hill.
- Thomson SW & Hunt RD. 1968. *Selected Histochemical and Histopathological Methods*. Charles C Thomas Publ.

VAN 606 GENERAL HISTOLOGY AND ULTRASTRUCTURE 3+1

Objective

To understand basic principles of light microscopy and ultrastructure of four basic tissues. light and

Theory

UNIT I

Light and ultrastructural details of animal cell.

UNIT II

Light and ultrastructural details of epithelial tissue.

UNIT III

Light and ultrastructural details of muscular tissue.

UNIT IV

Light and ultrastructural details of connective tissue.

UNIT V

Light and ultrastructural details of nervous tissue.

Practical

Demonstration of different components of cells and intercellular substances of the above referred tissues by special staining through the use of light, phase contrast, dark field, fluorescent and electron microscopes.

Suggested Readings

- Banks WJ. 1993. *Applied Veterinary Histology*. Mosby Year Book.
- Dellmann HD. 1993. *Text book of Histology*. Lea & Febiger.
- DiFiore MS, Mancini R & Derbertis EDP. 2006. *New Atlas of Histology*. Williams & Wilkins, Lippincott.
- Greep RO. 1977. *Histology*. McGraw-Hill.
- Ham AW & Cormack DH. 1979. *Histology*. JB Lippin.

VAN 607 SYSTEMIC HISTOLOGY AND ULTRASTRUCTURE 3+1

Objective

To understand and identify arrangement of four basic tissues in organs of different body systems.

Theory

UNIT I

Light and ultrastructure of different organs of digestive system of ruminants with differential features among domestic animals.

UNIT II

Light and ultrastructure of different organs of respiratory, lymphoid and cardiovascular systems.

UNIT III

Light and ultrastructure of different organs of urino-genital systems.

UNIT IV

Light and ultrastructure of different sense organs and nervous system.

Practical

Study of histological structure of organs of digestive, respiratory, urinary, genital and cardiovascular systems of buffalo, horse and dog/cat.

Suggested Readings

- Banks WJ. 1983. *Applied Veterinary Histology*. Mosby Year Book.
Dellmann HD. 1993. *Text Book of Histology*. Lea & Febiger.
DiFiore MS, Mancini R & Derbertis EDP. 2006. *New Atlas of Histology*.
Williams & Wilkins, Lippincott.
Greep RO. 1977. *Histology*. McGraw-Hill.
Ham AW & Cormack DH. 1979. *Histology*. JB Lippin.

VAN 608

DEVELOPMENTAL ANATOMY

3+1

Objective

To understand the developmental processes of different body systems at various stages of pregnancy.

Theory

UNIT I

Gametogenesis, fertilization, cleavage and gastrulation.

UNIT II

Development of foetal membranes and placenta in domestic animals.

UNIT III

Histogenesis of nervous system, sense organs, endocrine organs and cardiovascular system.

UNIT IV

Embryonic development of digestive, respiratory, uro-genital and musculoskeletal system.

Practical

Study of serial sections of the chick and pig embryos at different stages of development.

Suggested Readings

- Arey LB. 1965. *Developmental Anatomy*. WB Saunders.
Freeman WH & BraceGirdle B. 1967. *Atlas of Embryology*. Heilemann
Edu. Books Ltd.
Langman J. 1976. *Medical Embryology*. William & Wilkin.
Latshaw WK. 1984. *Veterinary Developmental Anatomy; A Clinically
Oriented Approach*. B.C. Decker Inc., Philadelphia.
Patten BM. 1985. *Foundation of Embryology*. Tata McGraw-Hill.
Tuchmann-Duplessis MH, David G & Haegel P. 1972. *Illustrated Human
Embryology*. Vol. I. Embryogenesis. Springer Verlag. Tuchmann-
Duplessis MH, David G & Haegel P. 1972. *Illustrated Human
Embryology*. Vol. II. Organogenesis. Springer Verlag.

Suggested Broad Topics for Master's Research

- * Gross anatomical disposition of various organs of animals of local interest
- * Light and ultra-structural studies of important organs and systems of animals of local importance
- * Developmental studies of different body systems

2. VETERINARY PHYSIOLOGY

Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
VPY 601	PHYSIOLOGY OF DIGESTION	2+1
VPY 602	CARDIOVASCULAR AND RESPIRATORY PHYSIOLOGY	2+1
VPY 603	RENAL PHYSIOLOGY AND BODY FLUID DYNAMICS	2+1
VPY 604	HAEMATOLOGY	2+1
VPY 605	VITAMINS AND MINERALS IN ANIMAL PHYSIOLOGY	2+0
VPY 606	PHYSIOLOGY OF ANIMAL REPRODUCTION	2+1
VPY 607	CLINICAL PHYSIOLOGY	2+1
VPY 608	NEUROMUSCULAR PHYSIOLOGY	2+1
VPY 609	CHEMICAL BIOREGULATION IN PHYSIOLOGICAL FUNCTIONS	3+0
VPY 610	RESEARCH TECHNIQUES IN VETERINARY PHYSIOLOGY	0+2
VPY 691	MASTER'S SEMINAR	1+0
VPY 699	MASTER'S RESEARCH	20

Major Subject	Minor Subjects*
Veterinary Physiology	Veterinary Anatomy, Veterinary Biochemistry, Veterinary Pharmacology & Toxicology, Animal Nutrition, Veterinary Gynaecology and Obstetrics, Livestock Production and Management, Animal Genetics & Breeding

* The choice of minor courses other than those listed above, may be allowed on the recommendations of advisory committee, if essentially required as per the research problem, with the concurrence of Head of the Department and Dean, Post Graduate Studies

VETERINARY PHYSIOLOGY

Course Contents

VPY 601 PHYSIOLOGY OF DIGESTION 2+1

Objective

To teach comparative physiology of digestive system of monogastric animals, ruminants and birds, and basic techniques.

Theory

UNIT I

Basic characteristics and comparative physiology of digestive system of domestic animals.

UNIT II

Gastro-intestinal motility, secretory functions of gastro-intestinal tract, their regulation and gastro-intestinal hormones.

UNIT III

Absorption, metabolism and excretion of various nutrients, appetite and control of feed intake.

UNIT IV

Development of ruminant system and rumen environment. Ruminant microbial digestion, its advantages and disadvantages. Rumino-reticular motility, its significance and control.

UNIT V

Rumen microbiology. Digestion in birds.

Practical

Collection of saliva and its enzymatic studies. Activity of pepsin and trypsin enzymes. Gastric and intestinal motility. Estimation of digestive metabolites such as glucose, ketone bodies, triglycerides, cholesterol, urea-nitrogen and total proteins. Liver function tests. Method of collection of rumen liquor, merits and demerits. Determination of pH, total volatile fatty acids, ammonia-nitrogen and total-nitrogen in strained rumen liquor. Rate of passage of digesta and its estimation. Rumino-reticular movements. Artificial rumen, counting of protozoa and bacteria.

Suggested Readings

- Cunningham JG. 1992. *Text book of Veterinary Physiology*. WB Saunders.
Swenson MJ & Reece WO. 2005. *Duke's Physiology of Domestic Animals*. Panima.
D.C. Church. (1988) *Digestive Physiology & Nutrition of Ruminants*. Praeice Hall.
Hungate R.E. 1966. *Rumen and its Microbes*. Acad. Press. N.Y.
Forbes JM. & France J. 1993. *Quantitative aspects of Ruminant Digestion & Metabolism*. CAB International. Cambridge. UK

VPY 602 CARDIOVASCULAR AND RESPIRATORY PHYSIOLOGY 2+1

Objective

To teach function and regulation of heart, recording of ECG and respiration in different animals and basic techniques.

Theory

UNIT I

Heart muscle, heart as pump, origin and propagation of heart beat. Electrophysiology of heart, rhythmic excitation of heart, cardiac cycle, heart sound and dynamics of valvular and congenital heart defect.

UNIT II

Cardiac output and its measurements, factors affecting cardiac output. Venous return and its regulation. Control of the heart.

UNIT III

Normal electro-cardiogram, electrocardiographic interpretation in cardiac myopathies and cardiac arrhythmias.

UNIT IV

Circulation and hemodynamics, coronary, systemic and pulmonary circulation, their regulation, energetics of circulation, pathophysiology of circulation.

UNIT V

Respiration, mechanism of ventilation, hemoglobin, oxygen and carbon-dioxide transport. Respiratory gas exchange. Respiratory adjustment at high altitude and deep swimming. Neural and chemical control of respiration, artificial respiration. Respiration in birds.

Practical

Determination and recording of cardiac output, blood pressure and electrocardiogram, blood volume. Estimation of lung volumes and capacities by spirometry, effect of various levels of exercise on lung functional capacities. Estimation of blood gases.

Suggested Readings

Cunningham JG. 1992. *Text book of Veterinary Physiology*. WB Saunders.
Swenson MJ & Reece WO. 2005. *Duke's Physiology of Domestic Animals*. Panima.
Patton 1989. *Howell's Text book of Physiology*. WB. Saunders.
Ganong FW. 2003. *Review of Medical Physiology*. Prentice-Hall.

VPY 603

RENAL PHYSIOLOGY AND BODY FLUID DYNAMICS 2+1

Objective

To impart knowledge regarding excretory system of mammals and birds, maintenance of body fluid homeostasis.

Theory

UNIT I

An overview of nephron structure and function. Renal homeostatic function and renal excretory function.

UNIT II

Quantitative analysis of renal function, renal haemodynamics. Glomerular filtration- its mechanism and measurement. Permeability of the glomerular capillary wall, structural basis of GFR, tubular reabsorption and transport.

UNIT III

Role of kidney in acid-base balance. Physiology of micturition, endocrine control of renal function. Non excretory functions of kidney.

UNIT IV

Skin- general anatomy of epidermis, dermis, hypodermis, mechanical protection, permeability, actinic irradiation, sweat glands, sebaceous glands. Skin grafting. Immune properties of skin.

UNIT V

Composition of body fluids and their regulation. Excretory system in birds.

Practical

Collection and preservation of urine. Physical and chemical analysis of urine and its interpretation in health and disease condition. Demonstration of various kidney function tests, glomerular filtration rate, creatinine clearance rate, urea clearance rate and glucose tolerance test.

Suggested Readings

Klahar S. 1983. *The Kidney and Body Fluids in Health and Diseases*. Plenum Press.

Swenson MJ & Reece WO. 2005. *Duke's Physiology of Domestic Animals*. Panima.

VPY 604

HAEMATOLOGY

2+1

Objective

To acquaint the students about haematology of different animals including hands-on training.

Theory

UNIT I

Red blood cells, anaemia, different types of anaemia, polycythemia and their effect on circulation in mammals and birds.

UNIT II

Resistance of the body to infection, leukocytes, tissue macrophage system and inflammation.

UNIT III

Immunity, immunoglobulins, immunogenetics, polymorphism in hemoglobin, transferrin etc. Changes in blood during diseases. Iatrogenic blood diseases, hemorrhagic diathesis, hemophilias.

UNIT IV

Hemostasis and coagulation factors, role of platelets, fibrinolysis. Blood groups, transfusion of blood. Tissue and organ transplantation. Conditions causing bleeding disorders.

Practical

Haemograms, platelet count, erythrocyte fragility. Estimation of serum iron and iron binding capacities of plasma. Separation of variants of hemoglobin and transferrin by electrophoresis. Examination of bone marrow. Isolation of different types of blood cells by sedimentation and column chromatography.

Suggested Readings

Dacie JV & Lewis SM. 1991. *Practical Hematology*. Churchill Livingstone.

Jain NC. 1993. *Essentials of Veterinary Hematology*. Lea & Febiger.

Rapaport SI. 1987. *Introduction to Hematology*. JB Lippincott.

VPY 605

VITAMINS AND MINERALS IN ANIMAL PHYSIOLOGY 2+0

Objective

To teach the importance of these nutrients in normal body functions and in disease conditions.

Theory

UNIT I

Introduction and brief history, definition, general properties and overview of functions.

UNIT II

Fat soluble vitamins, their functions and deficiency diseases.

UNIT III

Water soluble vitamins and vitamin-like compounds, their functions and deficiency diseases.

UNIT IV

Physiological functions of trace elements, their role in metabolism, toxicity, deficiency diseases.

Suggested Readings

McDowell LR. 1989. *Vitamins in Animal Nutrition*. Academic Press.

Underwood EJ. 1977. *Trace Elements in Human and Animal Nutrition*. Academic Press.

VPY 606

PHYSIOLOGY OF ANIMAL REPRODUCTION

2+1

Objective

To impart knowledge of male and female reproductive system of different species of animals including birds.

Theory

UNIT I

Functional histomorphology of male and female reproductive system, development of male and female sex organs. Endocrine and neuroendocrine relation in male and female reproductive function in different domestic animals.

UNIT II

Sexual cycles and mating behaviours in females, oogenesis, folliculogenesis and ovulation. Secretions of female reproductive tract in different species of animals.

UNIT III

Male mating behaviour, spermatogenesis, spermiogenesis, Seminiferous, epithelial cycles. Spermatozoa- structure and composition, maturation and transportation. Secretions of male reproductive tract.

UNIT IV

Transport of male and female gametes, fertilization, implantation. Pregnancy and parturition. Post-partum recovery in different species of domestic animals.

Practical

Heat detection in different animals, palpation of reproductive organs. Physical and biochemical evaluation of semen, determination of sperm enzyme, leakage during freezing. Preservation of semen, RIA of steroid hormones.

Suggested Readings

Hafeez ESE. 2000. *Reproduction in Farm Animals*. Lippincott, Williams & Wilkins.

Pineda & Doley 2003. *McDonald's Veterinary Endocrinology*. Iowa State University Press, Ames.

Salisbury GW & Demark NL. 1978. *Physiology of Reproduction and Artificial Insemination*. WB Saunders.

Swenson MJ & Reece WO. 2005. *Duke's Physiology of Domestic Animals*. Panima.

VPY 607 CLINICAL PHYSIOLOGY 2+1 Objective

To teach physiological basis of clinical abnormalities in body functions.

Theory

UNIT I

Cardiovascular, respiratory, hepatic and renal evaluation of body functions in relation to clinical conditions.

UNIT II

Carbohydrate, fat, protein and mineral metabolism in health and disease of various species.

UNIT III

Functions and dysfunctions of liver, kidney and gastro-intestinal tract.

UNIT IV

Clinico-immunological evaluation of immune responses and clinical enzymology.

Practical

Qualitative tests for glucose, ketone bodies, protein and calcium in urine. Quantitative determination of glucose in blood and urine. Electrophoresis of plasma proteins. Determination of sodium and potassium in serum. Determination of serum chloride. Separation of amino acids. Thin-layer chromatography of serum lipids.

Suggested Readings

- Henry RJ. 1974. *Clinical Chemistry. Principles and Techniques*. Harper D Row Publishers.
- Kaneko JJ, Harvey JW & Bruss ML. 1997. *Clinical Biochemistry of Domestic Animals*. Academic Press.
- King EJ & Wooton IDP. 1956. *Microanalysis in Medical Biochemistry*. Churchill Livingstone.
- Oser BL. 1976. *Hawk's Physiological Chemistry*. Tata McGraw-Hill.
- Rose BD. 1989. *Clinical Physiology of Acid Base and Electrolyte Disorders*. McGraw-Hill.
- Tietz NW. 1970. *Fundamentals of Clinical Chemistry*. WB. Saunders.

VPY 608

NEUROMUSCULAR PHYSIOLOGY

2+1

Objective

To impart knowledge of coordination of body functions and regulation of brain functions and sense organs.

Theory

UNIT I

Types and classification of muscles, comparative histopathology of muscles. Skeletal muscle fibers, membrane and action potential at myoneuronal junction. Molecular characteristics of contractile filaments, molecular mechanism of muscle contraction, relationship between actin and myosin filaments, overlap and tension developed by the contracting muscles. Contractile process of smooth muscles.

UNIT II

Length and tension relationship, force and velocity relationship. Skeletal muscle energetics, metabolism and lactate shuttle. Exercise, adaptation to training and performance. Neuromuscular disorders of domestic animals.

UNIT III

Nervous system, synapse, transmission and processing of information, receptors, brain and spinal reflexes, motor functions of brain stem, limbic system, memory, sleep, learning, autonomic nervous system.

UNIT IV

Special senses and somatic senses.

Practical

Recording of electro-myogram, fatigue, tetanus in muscles. Effect of temperature on different types of muscles, demonstration of intestinal movements, effect of drugs on all types of muscles, estimation of muscles specific enzymes.

Suggested Readings

Basmajian JV. 1978. *Muscle Alive: their Functions Revealed by Electromyography*. Williams & Wilkins.

Cooper R. 1980. *EEG Technology*. Butterworths, London.

Klemm. WR. 1969. *Animal Electroencephalography*. Acad. Press Inc. New York.

Smith R.F. 1978. *Fundamentals of Neurophysiology*. Springer Verlag.

Swenson MJ & Reece WO. 2005. *Duke's Physiology of Domestic Animals*. Panima.

VPY 609

CHEMICAL BIOREGULATION IN PHYSIOLOGICAL FUNCTIONS

3+0

Objective

To acquaint the students about different endocrine glands of the body and their relationship with production.

Theory

UNIT I

Methods of study bioregulation including methods of endocrine analysis. Manipulation and disruption of biorhythms in homeostatic and natural ecosystem.

UNIT II

Hormonal relationship in animal production. Concepts in hormone function, classification and methods of study. Hormonal assay, mechanism of hormone synthesis, release and transport. Mechanisms of hormone action, target cell interactions.

UNIT III

Genetic and genomic approaches in endocrinology. Animal models and alternate uses of animal model. Regulation and metabolism of hypothalamic, hypophyseal, thyroid and adrenal hormones.

UNIT IV

Gonadal and placental hormones, their regulation and mechanism of action. Hormonal principles of pineal gland and its role in production.

UNIT V

Endocrine control of carbohydrate and calcium homeostasis. Hormones and adaptation to environment. Hormonal regulation of gastro-intestinal activity. Prostaglandins. Hormones in fertility regulation and production augmentation. Avian endocrinology.

Suggested Readings

Pineda MH & Doley MP. 2003. *McDonald's Veterinary Endocrinology*. Blackwell Publ.

Turner CD & Bagnara JT. 1976. *General Endocrinology*. WB Saunders.

Williams RH. 1982. *Text Book of Endocrinology*. WB Saunders.

Objective

Training in various techniques for application in research in Animal Physiology.

Practical

Recording of ECG, EMG, blood pressure, pulse rate, movement of GI tract by Physiograph. Gas Liquid Chromatography. Electrophoresis. Estimation of various electrolytes. Estimation of bacterial production rate and VFA production rate, solid and liquid digesta flow rates and body composition using radio-isotopes, *in vitro* and *in sacco* rumen studies, ELISA. R.I. A. techniques of various hormones.

Suggested Readings

Abraham GE. 1977. *Handbook of Radioimmunoassay*. Marcel Dekker. Armstrong ML. 1978. *Electrocardiograms: A Systematic Method of Reading Them*. KM Verghese.
Oser BL. 1976. *Hawk's Physiological Chemistry*. Tata McGraw-Hill. Smorto MP & Basmajian JV. 1979. *Clinical Electroneurography - An Introduction to Nerve Conduction Tests*. Williams & Wilkins.

Suggested Broad Topics for Master's Research

- * Manipulation of rumen fermentation to enhance growth and productivity in ruminants.
- * Normal renal functions of domestic animals.
- * To study the mechanism of regulation of various hormones involved in production and reproduction in domestic animals.
- * Dietary effects on growth and production in poultry.

3. VETERINARY BIOCHEMISTRY

Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
VBC 601	CHEMISTRY OF ANIMAL CELL	2+0
VBC 602	TECHNIQUES IN BIOCHEMISTRY	0+2
VBC 603	APPLICATIONS OF GENOMICS AND PROTEOMICS IN MOLECULAR BIOLOGY	2+0
VBC 604	BIOCHEMISTRY OF BIOMOLECULES: CARBOHYDRATES, LIPIDS AND MEMBRANE'S STRUCTURE	2+0
VBC 605	ENZYME CATALYSIS, KINETICS, INHIBITION AND REGULATION	2+0
VBC 606	METABOLISM-I: CARBOHYDRATES AND LIPIDS	2+0
VBC 607	METABOLISM-II: NUCLEIC ACIDS AND AMINO ACIDS	2+0
VBC 608	METABOLISM-III: INTEGRATION AND REGULATION.	2+0
VBC 609	CENTRAL DOGMA AND PROTEIN FUNCTION	2+0
VBC 610	CLINICAL BIOCHEMISTRY OF ANIMALS	2+1
VBC 611	BIOCHEMICAL BASIS OF DISEASES OF DOMESTIC ANIMALS	2+0
VBC 612	ENDOCRINOLOGY AND REPRODUCTIVE BIOCHEMISTRY	2+0
VBC 613	BIOCHEMICAL BASIS OF ANIMAL PRODUCTION	2+1
VBC 691	MASTER'S SEMINAR	1+0
VBC 699	MASTER'S RESEARCH	20

Major Subject	Minor Subjects*
Veterinary Biochemistry	Veterinary Physiology, Veterinary Microbiology, Veterinary Medicine, Animal Biotechnology, Veterinary Pharmacology & Toxicology, Animal Nutrition, Animal Genetics & Breeding

* The choice of minor courses other than those listed above, may be allowed on the recommendations of advisory committee, if essentially required as per the research problem, with the concurrence of Head of the Department and Dean, Post Graduate Studies

VETERINARY BIOCHEMISTRY

Course Contents

VBC 601	CHEMISTRY OF ANIMAL CELL	2+0
Objective	Teaching of principles of physical chemistry as applicable to veterinary sciences.	
Theory	<u>UNIT I</u> Pre-biotic world, chemical evolution. cellular architecture, molecular organization and metabolic function. <u>UNIT II</u> Thermodynamics, chemical equilibrium, standard state, living cell as steady state, open system obeying laws of thermodynamics. Minimum energy conformation, quantum mechanical calculation. ΔG and ATP. <u>UNIT III</u> Properties of water, homeostasis, pH, osmosis, viscosity, surface forces adsorption, dialysis, diffusion rate and the sizes of organisms. The blood buffering system. Chemical basis of oral and parental fluid/electrolyte therapies, Bacterial toxigenic diarrhoeas.	
Suggested Readings	Chang 2005. <i>Physical Chemistry for the Bioscience</i> . Univ. Science Books. Dvorak AM & Harris W. 1991. <i>Blood Cell Biochemistry</i> . 2 nd Ed. Plenum. Garby L. 1995. <i>Bioenergetics</i> . Cambridge. Voet D, Voet JG & Pratt CW. 2006. <i>Fundamentals of Biochemistry of Life at the Molecular Level</i> . 2 nd Ed. John Wiley & Sons.	
VBC 602	TECHNIQUES IN BIOCHEMISTRY	0+2
Objective	To make students well versed with methodologies used in biochemistry.	
Practical	Solving problems using Henderson–Hasselbalch equation, pH, pKa and buffer concentration, normality. Application of colorimetry, spectrophotometry and NMR-X ray crystallography. Paper, column and thin layer chromatography. Partition and adsorption coefficient, quantitative and qualitative chromatography of amino acids, lipids and sugars including elution. Gas chromatography. Packing of column and choice of detectors and densitometry. Application of electrophoresis. Electrophoresis of proteins and nucleic acids. Use of sodium dodecyl sulfate and molecular weight determination. Densitometry procedures and quantitative assays. Immunoelectrophoresis, its applications. Isoelectrofocussing and isotacophoresis. Molecular sieving and its application in Biochemistry. General properties of dextran, acrylamide, agar and other media used for gel filtration. Ultracentrifugation– its principle and use, preparative analytical and density gradient ultracentrifugation. Fractionation of sub-cellular components and molecular weight determination using ultracentrifuge.	
Suggested Readings	David L Nelson & Cox Michael M. 2007. <i>Lehninger's Principles of Biochemistry</i> . 4 th Ed. Freeman.	

- Garrity S. 1999. *Experimental Biochemistry*. 3rd Ed. Academic Press.
Gowenlock AH. 1996. *Varley's Practical Clinical Biochemistry*. 6th Ed. CBS.
Holme DJ & Hazel P. 1983. *Analytical Biochemistry*. Longman.

VBC 603

**APPLICATIONS OF GENOMICS AND
PROTEOMICS IN MOLECULAR BIOLOGY**

2+0

Objective

To acquaint students about molecular basis of structure and functional aspects of NA and AA.

Theory

UNIT I

Nucleotides, nucleic acids, high order structures, cohesions and condensins in chromosome structure. SMC proteins, sequencing, mutation, evolution. DNA libraries. Bacterial RNA polymerase, RNA interference. DNA replication, RNA synthesis, control of gene expression. DNA microarrays/chips.

UNIT II

PCR, Recombinant DNA technology in improving domestic animals. RELP, Gene and gene products. Genetic changes in hereditary diseases, cancer and detection ion DNA probes. Gene Therapy DNA vaccines, anti-tumor antibodies. Telomerases and Topoisomerases in treatment of diseases. *Staphylococcus* resistance to erythromycin.

UNIT III

Peptide bonds, acid-base properties, stereochemistry, side chain modifications, biological activities. Green fluorescent protein. Polypeptide diversity, protein purification and analysis, protein sequencing, reconstructing the sequence. Gene duplication and protein families, protein modules, combinatorial peptide libraries folding. Structural bio-informatics. Protein structure prediction and design. Proteomics. Drug molecules, myoglobin and haemoglobin. Mechanism and co-operativity in Hb. High altitude adaptation in ruminants and equines. Use of amino acid analysis in disease diagnosis.

Suggested Readings

- David L Nelson & Cox Michael M. 2007. *Lehninger's Principles of Biochemistry*. 4th Ed. Freeman.
Murray RK, Granner DK, Mayes PA & Rodwell, VK. 2000. *Harper's Biochemistry*. Lange Medical Book.
Voet D, Voet JG & Pratt CW. 2006. *Fundamentals of Biochemistry of Life at the Molecular Level*. 2nd Ed. John Wiley & Sons.

VBC 604

**BIOCHEMISTRY OF BIOMOLECULES:
CARBOHYDRATES, LIPIDS AND MEMBRANE'S
STRUCTURE**

2+0

Objective

Teaching of molecular basis of structure and functional aspects of carbohydrates and lipids.

Theory

UNIT I

Carbohydrates: Structure, glycoconjugates in cell surface, extra cellular matrix, sugar code functions, peptidoglycan-specific antibiotics. Cellular effects of Insulin. Glucose supply and removal, Ruminant fermentation, role of liver, glucose tolerance, indirect monitoring of blood glucose, ketone bodies.

UNIT II

Lipid classification, metabolism of LCFA, TAG, PL, Sphingolipids, cholesterol, lipoproteins. Regulation of lipid metabolism in fed and fasted states. Regulation of FA oxidation. FAs as regulatory molecules. Glucose production and FAs in type II diabetes. Ketone bodies as fuel.

UNIT III

Lipid bilayers, lipid motility, integral membrane proteins, lipid linked proteins, peripheral membrane proteins, fluid mosaic model, membrane skeleton, lipid asymmetry, vesicle trafficking, secretory pathway, membrane rafts, caveolae fusion, lung surfactant, structure of bacterial rhodopsin. thermodynamics of membrane transport, ionophores, porins, ion channels, aquaporins, transport proteins, P and F types (Na⁺ - K⁺) ATPases, Ca²⁺, Ion-gradient, Gap Junction, Cl⁻-HCO₃⁻-exchanger, cardiac glycosides, abnormalities in cell membrane fluidity. Haemolytic anaemia.

Suggested Readings

Combs GF. 1992. *The Vitamins - Fundamental Aspects in Nutrition and Health*. Academic Press.

David L Nelson & Cox Michael M. 2007. *Lehninger's Principles of Biochemistry*. 4th Ed. Freeman.

Kaneko JJ, Harvey JH & Bruss ML. 1999. *Clinical Biochemistry of Domestic Animals*. 5th Ed. Academic Press.

VBC 605

ENZYME CATALYSIS, KINETICS, INHIBITION AND REGULATION 2+0

Objective

To give thorough knowledge of molecular basis of enzyme action in relation to diagnostic importance.

Theory

UNIT I

Mechanisms: Enzyme activation energy and reaction co-ordination, acid-base, covalent, metal ion. Proximity and orientation effects. Preferential transitional state binding.

UNIT II

Chemical kinetics, enzyme kinetics, kinetic data analysis, bisubstrate reactions. Competitive, Uncompetitive, Mixed inhibitors. Allosteric regulation. Drug design, drug discovery, bioavailability and toxicity, clinical trials. Cytochrome P450 and adverse drug reactions; synthesis of bacterial peptidoglycans, oxygenases, mixed function oxidases. Enzyme linked diagnostics.

UNIT III

Lysozyme. Serine proteases, physiology and tumor cell metastasis. Nerve poisons, blood coagulation cascade, Equine immuno-deficiency enzyme inhibitors. Suicide activators (DFMO for inhibition of ornithine decarboxylases in trypanosomiasis).

Suggested Readings

- David L Nelson & Cox Michael M. 2007. *Lehninger's Principles of Biochemistry*. 4th Ed. Freeman.
- Hang C & Wang T. 1988. *Enzyme Dynamics and Regulation*. Springer-Verlag.
- Voet D, Voet JG & Pratt CW. 2006. *Fundamentals of Biochemistry of Life at the Molecular Level*. 2nd Ed. John Wiley & Sons.

VBC 606

METABOLISM-I: CARBOHYDRATES AND LIPIDS 2+0

Objective

To teach regulatory mechanisms of carbohydrates and lipids metabolism in health and diseases.

Theory

UNIT I

Metabolic control, analysis for enzymes limiting the flux through a pathway. Trophic strategies, universal mapping of metabolic pathways. Thermodynamic relationships. ΔG , ATP and phosphoryl group transfer, coupled reactions, thioesters, NAD⁺ and FAD.

UNIT II

Overview of carbohydrate and lipid cycles, control of glycolysis, glycolysis in cancer cells, control of pentose phosphate pathways, deficiency of glucose-6-phosphate dehydrogenase. Control of glycogen metabolism, control of gluconeogenesis. GSD. Regulation of citric acid cycle, pathways that use citric acid intermediates, Sugar interconversions and nucleotide – linked sugar formation. Disorders associated with impairment of metabolism.

UNIT III

Electron transport and oxidative phosphorylation. Generation of heat by uncoupling in brown adipose tissue.

UNIT IV

Regulation of fatty acid metabolism, inhibitors of fatty acids biosynthesis, sphingolipid degradation and lipid storage disease. Regulation of cholesterol synthesis. PGs in NSAID, leukotrienes, HETEs, hypersensitivity. Influence of glucose metabolism on lipid metabolism.

Suggested Readings

- David L Nelson & Cox Michael M. 2007. *Lehninger's Principles of Biochemistry*. 4th Ed. Freeman.
- Glaser JA & Deutscher MP. 1995. *Introduction to Biophysical Methods for Protein and Nucleic Acid Research*. Academic Press.
- Russell TR, Brew K, Faber H & Schultz J. 2001. *From Gene to Protein: Information Transfer in Normal and Abnormal Cells*. Miami Winter Symposium-16. Academic Press.
- Voet D, Voet JG & Pratt CW. 2006. *Fundamentals of Biochemistry of Life at the Molecular Level*. 2nd Ed. John Wiley & Sons.

VBC 607

METABOLISM–II: NUCLEIC ACIDS AND AMINO ACIDS

2+0

Objective

To understand regulatory mechanisms of amino acid and nucleic acid metabolism in health and diseases.

Theory

UNIT I

Overview of pathways of amino acid and nucleic acid metabolism. Lysosomal degradation, ubiquitin, proteasome, breakdown of amino acids, heme biosynthesis and degradation, biosynthesis of physiologically active amines. Nitric oxide, homocystein as marker of disease. Diseases of amino acid metabolism, porphyrias.

UNIT II

Nucleotide synthesis and degradation, inhibition of thymidylate synthesis in cancer therapy. Mutation in coenzyme binding sites and diseases. Forces stabilizing NA structure, restriction endonucleases, small inhibitory RNAs. Chromatin organization. Inhibitors of topoisomerases as antibiotic and anti-cancer agents, interfering with purine and pyrimidine metabolism.

UNIT III

Viral nucleic acids, DNA damage and repair, telomerase, ageing and cancer. Topoisomerases as drug targets. Chemotherapy can target precursors of DNA synthesis. Antibiotics and toxins that target RNA polymerase. Lysosomal enzymes, gout, diseases in purine and pyrimidine nucleotide metabolic impairment.

Suggested Readings

David L Nelson & Cox Michael M. 2007. *Lehninger's Principles of Biochemistry*. 4th Ed. Freeman.

Kaneko JJ, Harvey JH & Bruss ML. 1999. *Clinical Biochemistry of Domestic Animals*. 5th Ed. Academic Press.

Swenson MJ & Reece WO. 1996. *Dukes' Physiology of Domestic Animals*. 11th Ed. Panima.

Voet D, Voet JG & Pratt CW. 2006. *Fundamentals of Biochemistry of Life at the Molecular Level*. 2nd Ed. John Wiley & Sons.

VBC 608 METABOLISM–III: INTEGRATION AND REGULATION 2+0

Objective

To give exposure in inter-relationship of cellular metabolism of various macromolecules.

Theory

UNIT I

Regulation and integration of all metabolic pathways.

UNIT II

Organ specialization in fuel metabolism : Brain, muscle, adipose tissue, liver, kidney, inter organ metabolic pathways, hormonal control of fuel metabolism. Tracing metabolic fates, perturbing the system.

UNIT III

Signal transduction, gated ion channels, G-proteins, adenylate cyclase, receptor tyrosine kinase, protein phosphatases, cGMP, Ca²⁺, interaction with phosphoserine/tyrosine, integrations, drugs and toxins, cell cycle and CDKs that affect cell signaling.

UNIT IV

Oncogenes and cancers. Mitochondrial genes and diseases. Reactive oxygen species. Cyanide and arsenic poisoning. Metabolic inter-relationships in obesity, diabetes, cancer, aerobic and anaerobic exercise in horses, pregnancy, lactation and stress injury. Mitochondria in apoptosis

and oxidative stress. Cell suicide, liver diseases, renal diseases, acid-base balance. Metabolic/sensory transduction in nervous tissue. Vision. Blood coagulation.

Suggested Readings

Kaneko JJ, Harvey JH & Bruss ML. 1999. *Clinical Biochemistry of Domestic Animals*. 5th Ed. Academic Press.

Kurjan J & Taylor BL. 1993. *Signal Transduction*. Academic Press.

Voet D, Voet JG & Pratt CW. 2006. *Fundamentals of Biochemistry of Life at the Molecular Level*. 2nd Ed. John Wiley & Sons.

VBC 609

CENTRAL DOGMA AND PROTEIN FUNCTION 2+0

Objective

Teaching of applied aspects of replication, transcription and translation.

Theory

UNIT I

Overview of transcription and translation in eukaryotes. Collision between DNA polymerase and RNA polymerase, inhibitors of transcription, introns, evolution and expansion of the genetic code.

UNIT II

The effects of antibiotics and toxins on protein synthesis. X – chromosome inactivation. Eukaryotic gene expression, protein targeting.

UNIT III

Actin structure, microfilament dynamics, actin-myosin reacting cycle, tubulin dimer, microtubules dynamics, kinensins, dyeins.

UNIT IV

Antigen-antibody binding, cytokines, principles of immunochemical methods: agglutination, precipitation, typing of major histo-compatibility antigens. Blood group substances in farm animals.

UNIT V

Proteins as infectious agents (prions – BSE). Protein misfolding and aggregation. Plasma proteins, synthesis, functions. Influences of physiological factors and inflammation on proteins. Dysproteinemias. Defects in collagen synthesis. Transmissible multiple drug resistance, transcription factors and cardiovascular diseases. Transferrin, Lactoferrin, Ferritin and Ceruloplasmin.

Suggested Readings

Creighton TE. 1993. *Protein Structures and Molecular Properties*. WH Freeman.

David L Nelson & Cox Michael M. 2007. *Lehninger's Principles of Biochemistry*. 4th Ed. Freeman.

Voet D, Voet JG & Pratt CW. 2006. *Fundamentals of Biochemistry of Life at the Molecular Level*. 2nd Ed. John Wiley & Sons.

VBC 610

CLINICAL BIOCHEMISTRY OF ANIMALS 2+1

Objective

To make a student well versed with biochemical basis for diagnosis and prognosis of diseases in animals and poultry.

Theory

UNIT I

Disturbances of gastro-intestinal function, disturbances of rumen function. Lactic acidosis, Pickled pigs and malignant hyperthermia. Diagnosis of neuromuscular disorders.

UNIT II

Myocardial infarction, respiratory distress syndrome. Primary renal dysfunctions and test, doping. Problems in game horses.

UNIT III

Enzymes of diagnostic importance. Toxicity of ammonia in animals. Genetic defects in urea cycle. Lysosomal storage diseases. ATP synthase inhibitory protein during ischemia. Ischaemic – reperfusion injury.

UNIT IV

Molecular oncology and tumor markers. CSF characteristics in diseases. Clinical biochemistry in toxicology. Glycosylated hemoglobin, HbA1c, fructosamine. Deranged glucose metabolism in cancerous tissue. Free Radical damage.

Practical

Estimation of constituents (enzymes, metabolites and electrolytes) of body fluids during normal and pathological conditions. Estimation of hormones. Liver and kidney function tests. Total volatile fatty acids and the fractions in ruminants.

Suggested Readings

- Devlin 2005. *Textbook of Medical Biochemistry with Clinical Correlations*. Wiley Liss.
- Jurisica I & Wigle D. 2006. *Knowledge and Discovery in Proteomics*. CRC.
- Kaneko JJ, Harvey JH & Bruss ML. 1999. *Clinical Biochemistry of Domestic Animals*. 5th Ed. Academic Press.
- Liebler DL. 2002. *Introduction to Proteomics*. Humana Press.
- Pryor WA. 1996. *Free Radicals in Biology*. Academic Press.
- Searcy RL. 1969. *Diagnostic Biochemistry*. McGraw-Hill.

VBC 611

BIOCHEMICAL BASIS OF DISEASES OF DOMESTIC ANIMALS

2+0

Objective

To give a detailed overview of role of biomolecules in health and diseases in animals and poultry.

Theory

UNIT I

Diabetes mellitus, hyperinsulemia, galactosemia, hypoglycaemia of baby pigs, Glycogen Storage Disease. Carbohydrate balance in ruminants. Biochemical alterations in body fluids of ruminants in hypoglycaemia, Ruminant ketosis.

UNIT II

Hypercholesterolemia, atherosclerosis, hyperlipidemia in canine, feline, equine. Pathophysiology of ketonemia. Ketosis associated with fasting, diabetes, pregnancy, lactation and post exercise.

UNIT III

Anemias of the newborn, cytosolic enzyme deficiencies and membrane abnormalities in erythrocytes. Porphyrins and porphyrias. Disorders of iron

metabolism, neutrophil function defects and its testing. Equine immunodeficiency.

UNIT IV

Hepatic insufficiencies and its laboratory assessment. Pancreatitis and insufficiency. Metabolic diseases of Ca, P, Mg metabolism. Iron overload and injection, inorganic polyphosphate metabolism.

Suggested Readings

David L Nelson & Cox Michael M. 2007. *Lehninger's Principles of Biochemistry*. 4th Ed. Freeman.

Kaneko JJ, Harvey JH, Bruss ML. 1999. *Clinical Biochemistry of Domestic Animals*. 5th Ed. Academic Press.

Voet D, Voet JG & Pratt CW. 2006. *Fundamentals of Biochemistry of Life at the Molecular Level*. 2nd Ed. John Wiley & Sons.

VBC 612

ENDOCRINOLOGY AND REPRODUCTIVE BIOCHEMISTRY

2+0

Objective

To give a conceptual discussion on role of biomolecules in health and diseases in animals and poultry.

Theory

UNIT I

Mechanism of hormone action, Receptor binding, biosynthetic and metabolic aspects in physio-pathology of hormones, factors, and minerals.

UNIT II

Metabolic functions of the hormones of the hypothalamus, pituitary, thyroid, parathyroid, pancreas, adrenal, pineal, ovaries and testes. Biochemistry of prostaglandins and related agents. Clinical endocrine aspects in production and reproduction status in domestic animals and poultry.

Suggested Readings

Morgane PJ & Panksepp J. 2002. *Hand Book of Hypothalamus*. Dekker.
Nes WR & McKean ML. 1977. *Biochemistry of Steroids and other Isoprenoids*. University Park Press.

Voet D, Voet JG & Pratt CW. 2006. *Fundamentals of Biochemistry of Life at the Molecular Level*. 2nd Ed. John Wiley & Sons.

VBC 613

BIOCHEMICAL BASIS OF ANIMAL PRODUCTION

2+1

Objective

To teach about biochemistry of draft capacity, meat production and dairy chemistry.

Theory

UNIT I

Chemistry of milk lipids, proteins, carbohydrates, minerals, vitamins, pigments, and enzymes. Structure of milk lipids, fat globular membranes, modification of milk fat. Milk proteins – casein, amino acid composition, whey proteins, immunoglobulins, genetic polymorphism. Carbohydrates: structure and sweetness.

UNIT II

The biochemistry controlling postmortem energy metabolism mechanisms. Application of genomic technologies to the improvement of meat quality of

farm animals. Identification of meat quality parameters by proteomics. Application of proteomics to understand the molecular mechanisms behind meat quality. Oxidative stability of post mortem muscles from sheep of various ages.

UNIT III

Metabolic demands of draft animals, and biochemical aspects of work and kinesiology.

Practical

Biochemical tests for proteins of meat, milk and egg and analysis of wool structure.

Suggested Readings

Eston R & Reilly T. 1986. *Kinanthropometry and Exercise Physiology*.

Laboratory Manual. E & FN SPON.

Hay JG. 2002. *Basic Mechanics of the Skeletal System*. Prentice Hall.

Hudson BJE. 1994. *New Developing Sources of Food Proteins*. Chapman & Hall.

Jenness R & Patton S. 2001. *Principles of Dairy Chemistry*. Wiley Eastern.

Miller GD, Jarus JK & McBean LD. 2004. *Dairy Food and Nutrition*. CRC.

Suggested Broad Topics for Master's Research

- * Biochemical parameters in body fluids of patients in livestock and poultry
- * Assay of enzymes for diagnosis of diseases in poultry and livestock.
- * Endocrine studies on domestic and companion animals in relation to production and health status

4. VETERINARY PHARMACOLOGY AND TOXICOLOGY

Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
VPT 601	GENERAL PHARMACOLOGY	2+0
VPT 602	AUTONOMIC AND AUTACOID PHARMACOLOGY	2+1
VPT 603	CNS PHARMACOLOGY	2+1
VPT 604	DIGESTIVE AND RESPIRATORY PHARMACOLOGY	2+0
VPT 605	CARDIOVASCULAR AND RENAL PHARMACOLOGY	2+0
VPT 606	ENDOCRINE AND REPRODUCTIVE PHARMACOLOGY	2+0
VPT 607	CHEMOTHERAPY	2+1
VPT 608	TOXICOLOGY OF XENOBIOTICS	2+1
VPT 609	TOXICOLOGY OF PLANTS AND TOXINS	2+0
VPT 610	PHARMACOLOGICAL TECHNIQUES	1+1
VPT 611	TECHNIQUES IN TOXICOLOGY	1+1
VPT 612	ETHNOPHARMACOLOGY	2+0
VPT 691	MASTER'S SEMINAR	1+0
VPT 699	MASTER'S RESEARCH	20

Major Subject	Minor Subjects
Veterinary Pharmacology and Toxicology	Veterinary Physiology, Veterinary Biochemistry, Veterinary Medicine, Veterinary Pathology, Animal Biotechnology

- The choice of minor courses other than those listed above, may be allowed on the recommendations of advisory committee, if essentially required as per the research problem, with the concurrence of Head of the department and Dean post graduate studies

VETERINARY PHARMACOLOGY AND TOXICOLOGY

Course Contents

VPT 601 GENERAL PHARMACOLOGY 2+0

Objective

To study the scope of pharmacology and to understand the basic mechanisms of drug actions and its effects.

Theory

UNIT I

History and scope of pharmacology, Principles of drug absorption, distribution, metabolism and elimination. Drug bioavailability and routes of administration.

UNIT II

Important pharmacokinetic parameters and their clinical significance.

UNIT III

Pharmacodynamics: mechanism of action and the relationship between drug concentration and effect; signal transduction mechanism and drug receptors for physiological regulatory molecules.

UNIT IV

Quantitation of drug -receptor interactions and elicited effects. Competitive and non-competitive antagonism. Factors affecting drug response. Adverse drug reactions.

Suggested Readings

Brunton LL. (Ed). 2005. *Goodman and Gilman's The Pharmacological Basis of Therapeutics*. 11th Ed. McGraw-Hill.

Richard AH. (Ed). 2001. *Veterinary Pharmacology and Therapeutics*. 8th Ed. Iowa State Univ. Press.

Sandhu HS & Rampal S. 2006. *Essentials of Veterinary Pharmacology and Therapeutics*. 1st Ed. Kalyani Publishers.

VPT 602 AUTONOMIC AND AUTACOID PHARMACOLOGY 2+1 Objective

To study the pharmacodynamics of autonomic drugs.

Theory

UNIT I

Anatomical and physiological considerations of autonomic nervous system (ANS).

UNIT II

Neurohumoral transmission in ANS.

UNIT III

Pharmacology of cholinergic agonists and antagonists.

UNIT IV

Pharmacology of adrenergic agonists and antagonists.

UNIT V

Ganglionic stimulants and blockers.

UNIT VI

Autacoids: Histamine, serotonin, kinins, eicosanoids and platelet activating factor.

Practical

Pharmacological experiments on intact and isolated preparations for studying the effects of various prototype drugs on vascular, intestinal, respiratory, urinary and reproductive smooth muscles, autonomic ganglia, skeletal muscles; blood pressure, ECG, heart etc.

Suggested Readings

- Brunton LL. (Ed). 2005. *Goodman and Gilman's The Pharmacological Basis of Therapeutics*. 11th Ed. McGraw-Hill.
- Richard AH. (Ed). 2001. *Veterinary Pharmacology and Therapeutics*. 8th Ed. Iowa State Univ. Press.
- Sandhu HS & Rampal S. 2006. *Essentials of Veterinary Pharmacology and Therapeutics*. 1st Ed. Kalyani Publishers.

VPT 603

CNS PHARMACOLOGY

2+1

Objective

To study the pharmacodynamics of drugs acting on CNS.

Theory

UNIT I

Anatomical and physiological considerations of central nervous system (CNS); neurohumoral transmission in CNS.

UNIT II

Historical development, theories, principles and stages of general anaesthesia.

UNIT III

Pharmacology of anaesthetics, sedatives, hypnotics, neuroleptics, antiepileptics.

UNIT IV

CNS stimulants, analeptics, opioid agonists and antagonists; non-steroidal anti-inflammatory agents, central and peripheral muscle relaxants, local anaesthetics, therapeutic gases. euthanizing agents. Doping.

Practical

Study of pharmacodynamics of prototype drugs of each group in experimental animals.

Suggested Readings

- Brunton LL. (Ed). 2005. *Goodman and Gilman's The Pharmacological Basis of Therapeutics*. 11th Ed. McGraw-Hill.
- Richard AH. (Ed). 2001. *Veterinary Pharmacology and Therapeutics*. 8th Ed. Iowa State Univ. Press.
- Sandhu HS & Rampal S. 2006. *Essentials of Veterinary Pharmacology and Therapeutics*. 1st Ed. Kalyani Publishers.

VPT 604

DIGESTIVE AND RESPIRATORY PHARMACOLOGY

2+0

Objective

To study the pharmacological aspects of drugs acting on digestive and respiratory systems.

Theory

UNIT I

Pharmacology of drugs acting on gastrointestinal tract. Appetite stimulants, emetics and anti-emetics.

UNIT II

Anti-ulcer drugs, modulators of gastric and intestinal motility and secretions.

UNIT III

Gastrointestinal protectants and adsorbents, laxatives and cathartics.

UNIT IV

Agents promoting digestive functions; bile acids and pancreatic enzymes, drugs affecting liver; rumen pharmacology.

UNIT V

Pharmacology of drugs acting on respiratory system: pathogenesis of inflammatory respiratory diseases.

UNIT VI

Bronchodilators, antitussives, mucolytics, expectorants, decongestants.

UNIT VII

Drugs used in treatment of asthma.

Suggested Readings

Brunton LL. (Ed). 2005. *Goodman and Gilman's The Pharmacological Basis of Therapeutics*. 11th Ed. McGraw-Hill.

Richard AH. (Ed). 2001. *Veterinary Pharmacology and Therapeutics*. 8th Ed. Iowa State Univ. Press.

Sandhu HS and Rampal S. 2006. *Essentials of Veterinary Pharmacology and Therapeutics*. 1st Ed. Kalyani Publishers.

VPT 605

CARDIOVASCULAR AND RENAL PHARMACOLOGY 2+0

Objective

To study the pharmacological aspects of drugs acting on CVS and kidneys.

Theory

UNIT I

Pharmacology of cardiac glycosides.

UNIT II

Antiarrhythmic, antihypertensive and antihyperlipidaemic drugs.

UNIT III

Drugs affecting vasomotor and cardiorespiratory reflex mechanisms and haemopoietic system.

UNIT IV

Coagulants and anticoagulants, thrombolytic agents.

UNIT V

Pharmacology of drugs affecting renal functions and fluid-electrolyte balance.

UNIT VI

Fluid and electrolyte therapy, diuretics, antidiuretics, uricosuric drugs.

Suggested Readings

Brunton LL. (Ed). 2005. *Goodman and Gilman's The Pharmacological Basis of Therapeutics*. 11th Ed. McGraw-Hill.

Richard AH. (Ed). 2001. *Veterinary Pharmacology and Therapeutics*. 8th Ed. Iowa State Univ. Press.

Sandhu HS & Rampal S. 2006. *Essentials of Veterinary Pharmacology and Therapeutics*. 1st Ed. Kalyani Publishers.

VPT 606 ENDOCRINE AND REPRODUCTIVE PHARMACOLOGY 2+0

Objective

To study the pharmacology of drugs affecting endocrine functions.

Theory

UNIT I

Pharmacology of drugs affecting endocrine functions of pituitary, thyroid, adrenals and pancreas.

UNIT II

Hormonal regulation of calcium and phosphorus homeostasis.

UNIT III

Pharmacology of drugs affecting male reproductive organs, spermatogenesis.

UNIT IV

Pharmacology of drugs affecting female reproductive organs, ovulation, oestrus, conception, gestation and lactation.

UNIT V

Oxytocic and tocolytic drugs.

Suggested Readings

Brunton LL. (Ed). 2005. *Goodman and Gilman's The Pharmacological Basis of Therapeutics*. 11th Ed. McGraw-Hill.

Richard AH. (Ed). 2001. *Veterinary Pharmacology and Therapeutics*. 8th Ed. Iowa State Univ. Press.

Sandhu HS & Rampal S. 2006. *Essentials of Veterinary Pharmacology and Therapeutics*. 1st Ed. Kalyani Publishers.

VPT 607

CHEMOTHERAPY

2+1

Objective

To study the recent advances of chemotherapeutic agents with relevance to pharmacological and therapeutic aspects.

Theory

UNIT I

General consideration and principles of chemotherapy, classification of chemotherapeutic agents; development of microbial resistance to antimicrobials, combination therapy.

UNIT II

Systemic and gut acting sulfonamides, diaminopyrimidines, quinolones sulfones, nitrofurans.

UNIT III

Penicillins, cephalosporins, beta-lactam antibiotics.

UNIT IV

Chloramphenicol, tetracyclines, macrolides, polymyxins, polypeptides.

UNIT V

Aminoglycosides and other antibiotics.

UNIT VI

Anti-protozoans, anthelmintics, ectoparasiticides.

UNIT VII

Antituberculosis, antifungal, antiviral and antineoplastic drugs.

Practical

General methods for assay of chemotherapeutic agents, antibiotic sensitivity tests, estimation of sulfonamides, penicillins, oxytetracyclines,

trimethoprim and nitrofurans in biological fluids to study their kinetics and bioavailability.

Suggested Readings

- Brunton LL. (Ed). 2005. *Goodman and Gilman's The Pharmacological Basis of Therapeutics*. 11th Ed. McGraw-Hill.
- Richard AH. (Ed). 2001. *Veterinary Pharmacology and Therapeutics*. 8th Ed. Iowa State Univ. Press.
- Sandhu HS & Rampal S. 2006. *Essentials of Veterinary Pharmacology and Therapeutics*. 1st Ed. Kalyani Publishers.

VPT 608

TOXICOLOGY OF XENOBIOTICS

2+1

Objective

To study the poisonings and their antidotal therapy in animals.

Theory

UNIT I

Principles and scope of toxicology, sources of poisoning.

UNIT II

General modes of action of poisons, detoxification, factors affecting toxicity, general principles of diagnosis and treatment of poisonings.

UNIT III

Toxicology of metals, agrochemicals, solvents and vapors, feed additives.

UNIT IV

Toxic effects of radiations and radioactive chemicals, genetic and developmental toxicology; forensic and regulatory aspects of toxicology.

Practical

Extraction, separation and detection of common poisons in toxicological specimens, study of toxicity and antidotal treatment in animals, designing of animal toxicity experiments and general toxicity tests.

Suggested Readings

- Klassen CD, Amdure MO & Doull J. (Eds). 1996. *Casarett & Doull's Toxicology: The Basic Sciences of Poisons*. 5th Ed. McGraw Hill.
- Sandhu HS & Brar RS. 2000. *Text Book of Veterinary Toxicology*. 1st Ed. Kalyani Publishers.
- Stive KE & Brown TM. 2006. *Principles of Toxicology*. 2nd Ed. CRC Press.

VPT 609 TOXICOLOGY OF PLANTS AND TOXINS 2+0 Objective

To impart knowledge of toxicity of poisonous plants & natural toxins.

Theory

UNIT I

Classification, identification and chemical constituents of poisonous plants. Plants containing cyanide, nitrate/nitrite, oxalate, lectins and cardiotoxic glycosides.

UNIT II

Plants producing lathyrism, thiamine deficiency and photosensitization.

UNIT III

Toxicology of mycotoxins: aflatoxins, rubratoxins, ochratoxins, trichothecenes, tremorgens and ergot.

UNIT IV

Animal bites and stings: snake venom, scorpion, spider and insect stings and toad poisoning. Bacterial toxins: botulism.

Suggested Readings

- Chopra SR, Badhwar RL & Ghosh S. 1984. *Poisonous Plants of India*. 1st Ed., Academic Publishers, Jaipur.
Klassen CD, Amdure MO & Doull J. (Eds). 1996. *Casarett & Doull's Toxicology: Basic Sciences of Poisons*. 5th Ed., McGraw Hill.
Sandhu HS and Brar RS. 2000. *Text Book of Veterinary Toxicology*. 1st Ed., Kalyani Publishers.

VPT 610

PHARMACOLOGICAL TECHNIQUES

1+1

Objective

To impart the knowledge of various basic pharmacological techniques and screening methods of drugs.

Theory

UNIT I

Principles of drug action and bioassay. Dose response curves and their analysis.

UNIT II

Techniques for setting up isolated and intact preparations.

UNIT III

Organization of screening programme of drugs; multidimensional screening procedures and gross observational methods.

Practical

Setting up of isolated and intact preparations, recording of BP in dog/rat, recording of ECG in rat, experiments on drug potentiation, antagonism and tachyphylaxis. Construction of dose-response plots, calculation of EC₅₀, dissociation rate constants, potency ratio, pA_x, pD_x and pD' _x values. Specific tests for evaluation of tranquillizing, hypnotic, analgesic, anti-convulsant, general and local anesthetic, muscle relaxant, anti-inflammatory, antipyretic, antiarrhythmic, antihypertensive, antihyperglycemic and anticholesterimic activities. Determination of potency ratio, median effective, toxic or lethal doses. Bioassay techniques.

Suggested Readings

- Ghosh MN. (Ed). 2005. *Fundamentals of Experimental Pharmacology*. 3rd Ed. Hilton & Co.
Kulkarni SK (Ed). 2004. *Handbook of Experimental Pharmacology*. 3rd Ed. Vallabh Prakashan.
Laurance DR & Bacharach AL. (Ed). 1964. *Evaluation of Drug Activities: Pharmacometrics*. Vols. I, II. Academic Press.
Parmar NS & Shiv Prakash 2006. *Screening Methods in Pharmacology*. 1st Ed. Narosa.
Seth UK, Dadkar NK & Usha G Kamat (Eds). 1972. *Selected Topics in Experimental Pharmacology*. 1st Ed. Kothari Book Depot.
Tallarida RJ & Murray RB. 1987. *Manual of Pharmacologic Calculations*. 2nd Ed. Springer Verlag.

VPT 611 **TECHNIQUES IN TOXICOLOGY** 1+1

Objective

To understand the animal toxicity tests and assessment of various toxicants using specific tests.

Theory

UNIT I

Animal models in toxicological studies.

UNIT II

Animal toxicity tests for acute, sub-acute and chronic toxicity.

UNIT III

Specific toxicity tests for neurotoxicity, immunotoxicity, developmental, behavioural, reproductive and inhalation toxicity, mutagenicity, carcinogenicity.

UNIT IV

Animal toxicological tests for the study of metabolism, synergism and antagonism.

Practical

Tests for acute, sub-acute and chronic toxicity, protocols and various specific toxicity tests. Assay for marker enzymes, analysis of toxicant residues in biological materials.

Suggested Readings

Derelanko MJ. 1995. *CRC Hand Book of Toxicology*. Manfred A. Holinger.

Gad SC & Chengelis CP. 1998. *Acute Toxicology Testing*. 2nd Ed. Academic Press.

Hayes AW. 1994. *Principles and Methods of Toxicology*. 3rd Ed. Raven Press.

VPT 612 **ETHNOPHARMACOLOGY** 2+0

Objective

To impart the knowledge and importance of traditional Indian medicine.

Theory

UNIT I

Historical aspects: Traditional Indian remedies and regional folklore in disease cure.

UNIT II

Classification, identification and chemical constituents of medicinal plants. Extraction, distillation, evaporation and other processes used in purification and preparation of active constituents from medicinal plants.

UNIT III

Standardization and clinical validation of bioactive molecules from vegetable sources. Therapeutic and adverse effects of potential herbal drugs. Indigenous drugs used as carminatives, antiseptics, antimicrobials, analgesics, and anti-inflammatory agents.

UNIT IV

Alternate systems of medicine in animals.

Suggested Readings

Agrawal VS. (Ed). 1997. *Drug Plants of India*. Kalyani Publishers.

Anjaria J. 2002. *Inventory of Traditional Veterinary Medicinal Practices in India*. GOI Publ., Pathik Enterprises, Ahmedabad.

- Bisset NG. (Ed). 1994. *Herbal Drugs and Phytopharmaceuticals*. CRC Press.
- Chopra RN, Nayar SL & Chopra IC. (Eds.). 2002. *Glossary of Indian Medicinal Plants*. NISCAIR, CSIR, New Delhi.
- Pushpangadan P, Nyman U & George V. (Eds). 1995. *Glimpses of Indian Ethnopharmacology*. TBGRI Publication.
- Rastogi RP & Mehrotra BN (Eds). 1993-95. *Compendium of Indian Medicinal Plants*. Vols. I-IV. Publication and Information Directorate, New Delhi.
- Tallarida RJ & Murray RB. 1987. *Manual of Pharmacologic Calculations*. 2nd Ed. Springer Verlag.

Suggested Broad Topics for Master's Research

- & Neuro- and Behavioural Toxicology of Agrochemicals
- & Pharmacokinetics and Pharmacodynamics of Newer Drugs
- & Ethnopharmacology
- & Autonomic Pharmacology of Ruminants
- & Autonomic Pharmacology of Poultry
- & Clinical Pharmacology
- & Clinical Toxicology

5. VETERINARY MICROBIOLOGY
Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
VMC 601	BACTERIOLOGY – I	3+1
VMC 602	BACTERIOLOGY – II	3+1
VMC 603	VETERINARY MYCOLOGY	1+1
VMC 604	GENERAL VIROLOGY	2+1
VMC 605	SYSTEMATIC ANIMAL VIROLOGY	3+1
VMC 606	PRINCIPLES OF IMMUNOLOGY	2+1
VMC 607	VACCINOLOGY	2+0
VMC 608	DIAGNOSTICS OF INFECTIOUS DISEASES	1+2
VMC 609	TECHNIQUES IN MICROBIOLOGY AND IMMUNOLOGY	0+3
VMC 691	MASTER'S SEMINAR	1+0
VMC 699	MASTER'S RESEARCH	20

Major Subject	Minor Subjects
Veterinary Microbiology	Animal Biotechnology, Veterinary Pathology, Veterinary Public Health, Veterinary Biochemistry

- The choice of minor courses other than those listed above, may be allowed on the recommendations of advisory committee, if essentially required as per the research problem, with the concurrence of Head of the department and Dean post graduate studies

VETERINARY MICROBIOLOGY

Course Contents

VMC 601 BACTERIOLOGY – I 3+1

Objective

To impart knowledge on general microbiology and important aerobic bacteria.

Theory

UNIT I

Introduction to historical development of cellular organization, genetic & chemical characteristics of eukaryotic and prokaryotic cells. Classification, nomenclature and identification; genetic characterization and numerical taxonomy. Bacterial cell structure, physiology and antigenic structure.

UNIT II

Determinants of pathogenicity and its molecular basis. Bacteriophages: temperate and virulent phages; lysogeny and lysogenic conversion. Bacterial genetics: bacterial variation, genetic transfer mechanisms (transformation, transduction and conjugation); plasmids, transposons and drug resistance; recombinant DNA technology.

UNIT III

Systemic study of following bacteria: Gram negative- aerobic rods and cocci, family *Pseudomonadaceae*, *Legionellaceae*, *Neisseriaceae*, and genus *Brucella*. Facultative anaerobic Gram negative rods, family- *Vibrionaceae*, *Pasteurellaceae*, *Enterobacteriaceae* and other genera.

Practical

Morphological characterization, cell fractionation, enrichment & isolation technology, various methods used in growth measurement and bacterial preservation, gene transfer experiment. Detailed characterization (biochemical, serological, pathogenicity) of bacteria.

Suggested Readings

- Glen Sonder J & Karen W Post 2005. *Veterinary Microbiology: Bacterial*
• *Fungal Agents of Animal Diseases*. Cold Spring Harbor Lab. Press.
Prescot LM, Harley JP & Klen DA. 2005. *Microbiology*. Wm. C. Brown Publ.
Tortora GJ, Funke BR & Case CL. 2004. *Microbiology: An Introduction*. Benjamin/Cummins Publ.

VMC 602 BACTERIOLOGY – II 3+1

Objective

To learn about spore forming bacteria and some important aerobes and anaerobes.

Theory

UNIT I

Systematic study of following pathogenic bacteria: Gram positive cocci, family *Micrococaceae*, endospore forming Gram positive rods and cocci, family *Bacillaceae* genus *Bacillus*, *Sporolactobacillus* and *Clostridium*. Spirochetes. Family *Spirochetaceae* and other families like *Spirillaceae*, coryneform bacteria, *Dermatophilaceae*, *Streptomycetaceae*.

UNIT II

Mycobacteria and *Nocardia*, family *Actinomycetaceae*. Atypical prokaryotes such as *Chlamydia*, *Rickettsiae*, *Mycoplasma*, *Acholeplasma*, *Spiroplasma*, *Anaeroplasm*a and *Thermoplasma*.

UNIT III

Regular non-sporing Gram positive rods such as *Listeria* and *Erysipel*as. Anaerobic Gram negative straight, curved and helical rods, family *Bacteriodaceae* and genus *Bacteroides* and *Fusobacterium*.

Practical

Detailed and comparative study of morphology, biochemical reactions, physiology, serology and pathogenicity of various bacteria studied in theory, isolation of bacteria from field materials leading to their characterization and identification.

Suggested Readings

- Glen Sonder J & Karen W Post 2005. *Veterinary Microbiology: Bacterial and Fungal Agents of Animal Diseases*. Cold Spring Harbor Lab. Press.
- Prescot LM, Harley JP & Klen DA. 2005. *Microbiology*. Wm. C. Brown Publ.
- Tortora GJ, Funke BR & Case CL. 2004. *Microbiology: An Introduction*. Benjamin/Cummins Publ.

VMC 603

VETERINARY MYCOLOGY

1+1

Objective

To learn general and pathogenic mycology.

Theory

UNIT I

Morphology, physiology, reproduction, cultural characters, classification of fungi, immunology of pathogenic fungi.

UNIT II

Systematic study of animal mycoses such as aspergillosis, candidiasis, cryptococcosis, epizootic lymphangitis, mycetomas, sporotrichosis, histoplasmosis, blastomycosis, coccidioidomycosis, haplomycosis, rhinosporidiosis, zygomycosis, mycotic abortion, mycotic mastitis, mycotic dermatitis, dermatophytoses, mycotoxicosis etc.

Practical

Collection and processing of clinical material for isolation of fungi. Study of gross and microscopic characters of pathogenic fungi.

Suggested Readings

- Glen Sonder J & Karen W Post 2005. *Veterinary Microbiology: Bacterial and Fungal Agents of Animal Diseases*. Cold Spring Harbor Lab. Press.

VMC 604

GENERAL VIROLOGY

2+1

Objective

To study general aspects of viral structure, classification, replication, interactions and immunity to viruses.

Theory

UNIT I

History of virology; origin and nature of viruses; biochemical and morphological structure of viruses; nomenclature and classification of viruses.

UNIT II

Replication of DNA and RNA viruses, viral genetics and evolution.

UNIT III

Genetic and non-genetic interactions between viruses, virus-cell interactions, viral pathogenesis, viral persistence, oncogenic viruses, epidemiology of viral infections.

UNIT IV

Immune response to viruses, viral vaccines, viral chemotherapy.

Practical

Orientation to a virology laboratory, preparation of equipment for sterilization, collection, preservation, transportation of samples and their processing, isolation and cultivation of viruses in animals/ birds, embryonated chicken eggs; media and reagents for cell culture, trypsinization and maintenance of monolayer cell cultures, isolation of virus in cell cultures, titration of viruses by 50% end-point cytopathogenicity, and haemagglutination; detection of viral antibodies by serum neutralisation test, agar gel precipitation test, haemagglutination inhibition and ELISA.

Suggested Readings

Acheson NH. 2006. *Fundamentals of Molecular Virology*. Wiley.

Carter J & Saunders V. 2007. *Virology: Principles and Applications*. 1st Ed. Wiley.

Knipe DM, Howley PM, Griffin DE. 2006. *Fields Virology*. 5th Ed. Vols. I, II. Lippincott, Williams & Wilkins.

Mahy BWJ & Kangaroo HO. 1996. *Virology Methods Manual*. Academic Press.

Murphy FA, Gibbs, EPJ, Holzmek MK & Studdert MJ. 1999. *Veterinary Virology*. 3rd Ed. Academic Press.

VMC 605

SYSTEMATIC ANIMAL VIROLOGY

3+1

Objectives

To study viral properties, epidemiology, pathogenesis, diagnosis and control of diseases caused by animal viruses.

Theory

UNIT I

Studies on animal viruses belonging to various families, and prion agents given below with reference to antigens, cultivation, pathogenesis, epidemiology, disease status in India, diagnosis, immunity and control.

Capripoxvirus, avipoxvirus, cowpoxvirus; bovine herpes viruses, equine herpes viruses, infectious laryngotracheitis virus, Marek's disease virus, pseudorabies virus, malignant catarrh fever virus; infectious canine hepatitis virus, egg drop syndrome virus, inclusion body hepatitis-hydropericardium virus, papillomatosis, canine parvoviruses, feline panleucopenia virus.

UNIT II

New castle disease virus, canine distemper virus, rinderpest virus, PPR virus; infectious bursal disease virus; rotavirus, blue tongue virus, African horse sickness virus; rabies virus, ephemeral fever virus, borna virus.

UNIT III

Infectious bronchitis virus, transmissible gastroenteritis virus; equine arteritis virus, equine encephalomyelitis viruses; swine fever virus, BVDV-mucosal disease virus; foot and mouth disease virus, duck hepatitis virus; visna/maedi virus, equine infectious anemia virus, avian leucosis complex virus, bovine leukemia virus, chicken anemia virus; prions: scrapie, bovine spongiform encephalopathy.

Practical

Isolation of viruses in embryonated eggs and cell cultures; cytopathogenicity of representative animal viruses viz., cell death, syncytia formation, inclusion body etc.; diagnosis of animal viruses employing various serological tests, viz., haemagglutination and haemagglutination inhibition for Newcastle disease virus, agar gel diffusion and virus neutralization test for infectious bursal disease viruses; diagnosis of IBD virus and rotavirus by latex agglutination test, serotyping of FMD virus by ELISA, electropherotyping of rotavirus, PCR for diagnosis of viral infections.

Suggested Readings

- Acheson NH. 2006. *Fundamentals of Molecular Virology*. Wiley.
- Carter J & Saunders V. 2007. *Virology: Principles and Applications*. 1st Ed. Wiley.
- Knipe DM, Howley PM, Griffin DE. 2006. *Fields Virology*. 5th Ed. Vols. I, II. Lippincott, Williams & Wilkins.
- Mahy, BWJ & Kangaroo HO. 1996. *Virology Methods Manual*. Academic Press.
- Murphy FA, Gibbs, EPJ, Holzmek MK & Studdert MJ. 1999. *Veterinary Virology*. 3rd Ed. Academic Press.

VMC 606

PRINCIPLES OF IMMUNOLOGY

2+1

Objective

To impart knowledge about fundamental principles of immunology and its applications in the field of infectious diseases.

Theory

UNIT I

History of immunology, immunity types, cardinal features, phylogeny. Vertebrate immune system: lymphoid organs and tissues; development of B and T lymphocyte repertoires and other leukocytes, differentiation markers and other distinguishing characters of leukocytes; lymphoid cells trafficking.

UNIT II

Antigens: fundamental features, types, factors affecting immuno-genicity, adjuvants. Antibodies: structure, functions and classification; theories of antibody production; immunoglobulin genes and genetic basis of antibody diversity. Complement system: activation pathways and biological activities.

UNIT III

Major histocompatibility complex: structure, functions and gene organization. T lymphocyte subsets. Antigen-specific T cell receptors: structure, gene organization and genetic basis of diversity. Immune response development: phases of humoral and cell-mediated immune response development, cellular interactions, properties and classification of various cytokines, immunoregulation.

UNIT IV

Immunity against veterinary infectious agents, immunological surveillance and cancer immunity, immunological tolerance, its breakdown and autoimmunity, immuno-deficiencies: types and examples, hypersensitivity: classification, mechanisms of induction and examples.

Practical

Preparation of antigens for laboratory animals immunization; production, collection and preservation of antisera; quantitation of immunoglobulins in antisera by zinc sulphate turbidity and single radial immunodiffusion; examination of lymphoid organs of animals; tests for *in vivo* and *in vitro* phagocytosis; separation and counting of peripheral blood lymphocytes; separation and concentration of immunoglobulin by ammonium sulphate precipitation and dialysis; demonstration of antigen- antibody interactions in serological tests such as agar gel precipitation, immunoelectrophoresis, bacterial agglutination, direct and passive hemagglutination, latex agglutination, complement fixation, enzyme-linked immunosorbent assay, immunoblotting.

Suggested Readings

Kindt TJ, Goldsby RA & Osborne BA. 2007. *Kuby Immunology*. 6th Ed. WH Freeman.

Male D, Brostoff J, Roth DB & Roitts I. 2007. *Immunology*. 7th Ed. Mosby-Elsevier.

Tizard IR. 2004. *Veterinary Immunology: An Introduction*. 7th Ed. Saunders/Elsevier.

VMC 607

VACCINOLOGY

2+0

Objective

To understand science and practice of vaccines for prevention of bacterial and viral diseases.

Theory

UNIT I

History of veterinary vaccinology. Vaccines: classification, comparison of major types. Components of various types of vaccines: immunogens, adjuvants, stabilizers, preservatives, vehicles. Vaccine qualities: definitions and methods of testing. Vaccine development: cost-effectiveness of preventive immunization programmes, stages of development, clinical trials and regulatory requirements.

UNIT II

Traditional vaccines: inactivated, attenuated and toxoid vaccines. Methods of construction of traditional vaccines: microbial cultures, embryonated eggs, cell culture. Seed-lots of vaccine organisms. Methods of inactivation and attenuation of pathogens.

UNIT III

Modern vaccines: nucleic acids, vectored vaccines, recombinant expressed immunogens, synthetic peptides, marker vaccines, etc. Combination/multivalent vaccines. Novel immunomodulators and delivery systems. Modern methods of vaccine construction: methods based on synthetic chemistry and rDNA technology.

UNIT IV

Vaccine formulation: pharmacopeal requirements. Vaccine stability and preservation: cold chain. Immunization schedules of veterinary vaccines, logistic problems and vaccination failure. Strategies of disease control and eradication by vaccination.

Suggested Readings

- Dodds WJ & Schulz R. (Eds). 1999. *Veterinary Vaccines and Diagnostics*. Vol. 41 (*Advances in Veterinary Medicine*) 1st Ed. Academic Press.
- Levine MM, Kaper JB, Rappuoli R, Liu MA & Good MF. 2004. *New Generation Vaccines*. 3rd Ed. Marcel-Dekker.
- Pastoret PP, Blancou J, Vannier C & Verschueren C. 1997. *Veterinary Vaccinology*. Elsevier.

VMC 608

DIAGNOSTICS OF INFECTIOUS DISEASES

1+2

Objective

To provide training in essential immunological and molecular diagnostic techniques.

Theory

UNIT I

Diagnosis of infectious diseases: an overview. Principles of serodiagnostic: agglutination-reaction based tests, precipitation-reaction based tests, complement fixation test and enzyme immunoassays.

UNIT II

Principles of molecular diagnostic tests: PCR, RT-PCR, Southern blotting, northern blotting, western blotting, dot-blot. DNA diagnostics versus serodiagnostics. Development and validation of diagnostic tests.

Practical

Serodiagnostic tests for infectious diseases: bacterial slide and microtitre plate agglutination, agar gel immunodiffusion test, passive hemagglutination, hemagglutination inhibition and latex agglutination tests, complement fixation test, enzyme linked immunosorbent immunoassays, dot-ELISA, fluorescent antibody technique, immuno-electron microscopy, virus neutralization test, etc.

Molecular diagnostic techniques: protein profiling of infectious agents by SDS-polyacrylamide gel electrophoresis, antigen profiling of infectious agents by immunoblotting, nucleic acids isolation from infectious agents, detection of infectious agent nucleic acids by various formats of polymerase chain reaction and reverse transcription-PCR, dot-blot technique, etc.

Suggested Readings

- Detrick B & Hamilton RG. (Eds). 2006. *Manual of Molecular and Clinical Laboratory Immunology*. 7th Ed. American Society for Microbiology.

- Rose NR, Friedman H & Fahey JL. (Eds). 1986. *Manual of Clinical Laboratory Immunology*. American Society for Microbiology.
- Weir DM. 1986. *Handbook of Experimental Immunology*. Vol. IV. Blackwell.

VMC 609

**TECHNIQUES IN MICROBIOLOGY
AND IMMUNOLOGY**

0+3

Objective

To learn various important techniques of bacteriology, virology and immunology.

Practical

Preparation of different media used in bacteriology and mycology; isolation and identification of bacteria and fungi; antibiotic sensitivity of micro-organisms from clinical specimens. Plasmid profiling, pathogenicity test in cell culture or laboratory animals, maintenance and preservation of bacteria and fungi.

Cryopreservation and reconstitution of preserved cell lines; Concentration and purification of animal viruses by chemical agents, differential centrifugation, density gradient centrifugation, and ultra filtration, etc. Storage of animal viruses by freeze drying and ultra freezing. Biophysical and biochemical characterization of animal viruses; Molecular characterization of viral protein and nucleic acid.

Immunoglobulin purification by salt precipitation and chromatographic techniques, anti-species antibody production, enzyme-linked immunosorbent assays for antigen and antibody detection, neutrophils and peritoneal macrophage isolation and demonstration of phagocytic activity, lymphocyte separation, lymphocyte proliferation assay, tuberculin-type delayed type hypersensitivity reaction.

Suggested Readings

- Coligan JE, Kruisbeek AM, Margulies DH, Shevach EM & Strober W. 2003. *Current Protocols in Immunology*. 3rd Ed. John Wiley & Sons.
- Detrick B & Hamilton RG. (Eds). 2006. *Manual of Molecular and Clinical Laboratory Immunology*. 7th Ed. American Society for Microbiology.
- Hay FC & Westwood OMR. 2002. *Practical Immunology*. 4th Ed. Blackwell.
- Mahy BWJ & Kangaro HO. 1996. *Virology Methods Manual*. Academic Press.
- Quinn PJ, Carter ME, Markey B & Carter GR. 1994. *Clinical Veterinary Microbiology*. Wolfe Publ.

Suggested Broad Topics for Master's Research

- * Isolation, identification and characterization of pathogenic bacteria for developing diagnostics and vaccines
- * Development of genetically modified bacteria for improved vaccine and genetically modified signatred bacteria for developing vaccine candidate that can differentiate vaccinated from infected animals
- * Development of molecular tools for studying evolution, quick diagnosis and molecular epidemiology of microbes

- * Molecular characterization and antigenic relationship of field isolates of important viruses of animals and poultry.
- * Isolation and characterization of field isolates of important viruses of livestock and poultry with the aim of development of diagnostics and candidate vaccines
- * Studies on immune responses and immunity to animal and poultry viruses
- * Investigation of the roles of proinflammatory cytokines in ovarian activity of buffaloes
- * Production of phage display libraries of bovine scFv for diagnostic and therapeutic uses
- * Development of novel delivery systems for developing mucosal veterinary vaccines

6. VETERINARY PARASITOLOGY

Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
VPA 601	VETERINARY HELMINTHOLOGY-I	2+1
VPA 602	VETERINARY HELMINTHOLOGY-II	2+1
VPA 603	VETERINARY ENTOMOLOGY AND ACAROLGY	2+1
VPA 604	VETERINARY PROTOZOOLOGY	2+1
VPA 605	PARASITOLOGICAL TECHNIQUES	0+2
VPA 606	CLINICAL PARASITOLOGY	1+1
VPA 607	TRENDS IN CONTROL OF LIVESTOCK AND POULTRY PARASITES	1+1
VPA 608	IMMUNOPARASITOLOGY	2+1
VPA 609	PARASITIC ZONOSSES	2+0
VPA 610	PARASITES OF ZOO AND WILD ANIMALS	2+1
VPA 611	MALACOCLOGY	1+1
VPA 691	MASTER'S SEMINAR	1+0
VPA 699	MASTER'S RESEARCH	20

Major Subject	Minor Subjects
Veterinary Parasitology	Veterinary Microbiology, Veterinary Pharmacology & Toxicology, Animal Biotechnology, Veterinary Pathology, Veterinary Biochemistry

- The choice of minor courses other than those listed above, may be allowed on the recommendations of advisory committee, if essentially required as per the research problem, with the concurrence of Head of the department and Dean post graduate studies

VETERINARY PARASITOLOGY

Course Contents

VPA 601

VETERINARY HELMINTHOLOGY - I

2+1

Objective

To learn about various aspects of trematode and cestode parasites of veterinary importance.

Theory

UNIT I

Introduction, history, classification, general account and economic importance of platyhelminths.

UNIT II

Morphology, epidemiology, life cycle, pathogenesis, clinical signs, diagnosis and control measures of trematodes belonging to families: Dicrocoeliidae, Opisthorchiidae, Strigeidae and Fasciolidae.

UNIT III

Morphology, epidemiology, life cycle, pathogenesis, clinical signs, diagnosis and control measures of trematodes belonging to families: Echinostomatidae, Heterophyidae, Plagiorchiidae, Troglotrematidae, Prosthogonimidae, Nanophyetidae and Paragonimidae.

UNIT IV

Morphology, epidemiology, life cycle, pathogenesis, clinical signs, diagnosis and control measures of trematodes belonging to families: Notocotylidae, Brachylemidae, Cyclocoelidae, Paramphistomatidae and Schistosomatidae.

UNIT V

Morphology, epidemiology, life cycle, pathogenesis, clinical signs, diagnosis and control measures of cestodes belonging to families: Mesocestoididae, Anoplocephalidae, Thysanosomidae, Dipylidiidae and Dilepididae.

UNIT VI

Morphology, epidemiology, life cycle, pathogenesis, clinical signs, diagnosis and control measures of cestodes belonging to families: Davaineidae, Hymenolepididae, Taeniidae and Diphylobothriidae.

Practical

Identification of trematode and cestode parasites; their eggs and intermediate hosts. Observation on parasitic stages in host tissues and associated pathological lesions.

Suggested Readings

Chowdhury N. and Toda I. 1994. *Helminthology*. Spinger Verlag, Narosa Publishing House.

Dalton JP. 1999. *Fasciolosis*. CABI.

Gibson DI. 2002. *Keys to the Trematoda*, Vol.1. CABI.

Khalil LF, Jones A & Bray RA. 1994. *Keys to the Cestode Parasites of Vertebrates*. CABI.

Kumar V. 1998. *Trematode Infections and Diseases of Man and Animals*. Kluwer Academic Publishers.

Lapage G. 2000. *Monning's Veterinary Helminthology and Entomology*. Greenworld Publ.

- Mehlhorn H. 1988. *Parasitology in Focus: Facts and Trends*. Springer Verlag.
- Singh G & Prabhakar S. 2002. *Taenia solium Cysticercosis*. CABI
- Sood ML. 2003. *Helminthology in India*. International Book Distributors.
- Soulsby E.J.L. 1982. *Helminths, Arthropods and Protozoa of Domesticated Animals*. Bailliere Tindal.

VPA 602

VETERINARY HELMINTHOLOGY - II

2+1

Objective

To learn about various aspects of nematodes, thorny-headed worms and leeches of veterinary importance.

Theory

UNIT I

Introduction, history, classification, general account and economic importance of nematodes and thorny-headed worms

UNIT II

Morphology, epidemiology, life cycle, pathogenesis, clinical signs, diagnosis and control measures of nematodes belonging to families: Ascarididae, Anisakidae, Oxyuridae, Heterakidae and Subuluridae.

UNIT III

Morphology, epidemiology, life cycle, pathogenesis, clinical signs, diagnosis and control measures of nematodes belonging to families: Rhabditidae, Strongyloididae and Strongylidae.

UNIT IV

Morphology, epidemiology, life cycle, pathogenesis, clinical signs, diagnosis and control measures of nematodes belonging to families: Trichonematidae, Amidostomidae, Stephanuridae, Syngamidae and Ancylostomatidae.

UNIT V

Morphology, epidemiology, life cycle, pathogenesis, clinical signs, diagnosis and control measures of nematodes belonging to families: Metastrongylidae, Protostrongylidae, Filaroididae, Trichostrongylidae, Ollulanidae, Crenosomatidae and Dictyocaulidae.

UNIT VI

Morphology, epidemiology, life cycle, pathogenesis, clinical signs, diagnosis and control measures of nematodes belonging to families: Spiruridae, Thelaziidae, Acuariidae, Tetrameridae, Physalopteridae, Gnathostomatidae, Filariidae, Setariidae, Onchocercidae and Dracunculidae.

UNIT VII

Morphology, epidemiology, life cycle, pathogenesis, clinical signs, diagnosis and control measures of nematodes belonging to families: Trichinellidae, Trichuridae, Capillariidae, Dioctophymatidae, Polymorphidae, Oligacanthorhynchidae and Gnathobdellidae.

Practical

Identification of nematode parasites; their eggs and intermediate hosts, differentiation, study of their stages in the tissues and associated pathological lesions.

Suggested Readings

- Andersen RC. 2000. *Nematode Parasites of Vertebrates, their Development and Transmission*. CABI.
- Kennedy MW & Harnett W. 2001. *Parasitic Nematodes: Molecular Biology, Biochemistry and Immunology*. CABI.
- Lapage G. 2000. *Monning's Veterinary Helminthology and Entomology*. Greenworld Publ.
- Lee DL. 2002. *The Biology of Nematodes*. Taylor and Francis.
- Soulsby E.J.L. 1982. *Helminths, Arthropods and Protozoa of Domesticated Animals*. Bailliere Tindal.

VPA 603 VETERINARY ENTOMOLOGY AND ACAROLOGY 2+1 Objective

To learn various aspects of arthropods of veterinary importance.

Theory

UNIT I

Introduction, history, classification and economic importance.

UNIT II

Distribution, life cycle, seasonal pattern, pathogenesis, economic significance and control of arthropods belonging to the families: Culicidae, Ceratopogonidae, Simuliidae and Psychodidae.

UNIT III

Distribution, life cycle, seasonal pattern, pathogenesis, diagnosis, economic significance and control of arthropods belonging to the families: Tabanidae, Gasterophilidae, Muscidae, and Glossinidae.

UNIT IV

Distribution, life cycle, seasonal pattern, pathogenesis, diagnosis, economic significance and control of arthropods belonging to the families: Oestridae, Sarcophagidae, Calliphoridae and Hippoboscidae.

UNIT V

Distribution, life cycle, seasonal pattern, pathogenesis, diagnosis, economic significance and control of arthropods belonging to the families: Pediculidae, Haematopinidae, Linognathidae, Menoponidae, Philopteridae and Trichodectidae

UNIT VI

Distribution, life cycle, seasonal pattern, pathogenesis, diagnosis, economic significance and control of arthropods belonging to the families: Siphonapteridae, Cimicidae and Reduviidae,

UNIT VII

Distribution, life cycle, seasonal pattern, pathogenesis, diagnosis, economic significance and control of arthropods belonging to the families: Dermanyssidae, Argasidae and Ixodidae

UNIT VIII

Distribution, life cycle, seasonal pattern, pathogenesis, diagnosis, economic significance and control of arthropods belonging to the families: Sarcoptidae, Psoroptidae, Demodicidae, Trombiculidae, Cytoditidae and Linguatulidae.

UNIT IX

Strategic control measures of arthropods with special emphasis on improved versions of chemical, biological and immunological control and integrated pest management.

Practical

Collection, preservation, identification and differentiation of various arthropods and their developmental stages; associated pathological changes and lesions; skin scraping examination.

Suggested Readings

- Gupta SK & Kumar R. 2003. *Manual of Veterinary Entomology and Acarology*. International Book Distr. Co.
- Harwood RF & James MT. 1979. *Entomology in Human and Animal Health*. MacMillan.
- Kettle DS. 1995. *Medical and Veterinary Entomology*. CABI.
- Lehane M. 2005. *The Biology of Blood Sucking Insects*. 2nd Ed. Cambridge University Press.
- Marquardt WC. 2000. *Parasitology and Vector Biology*. Academic Press
- Mullen G & Durben L. 2002 *Medical and Veterinary Entomology*. Academic Press
- Wall R & Shearer D. 1997. *Veterinary Entomology*. Chapman & Hall.

VPA 604

VETERINARY PROTOZOOLOGY

2+1

Objective

To project the importance and to impart detailed knowledge on various aspects of protozoan parasites.

Theory

UNIT I

Introduction, history, classification, general account, economic importance of protozoan parasites.

UNIT II

Morphology, epidemiology, pathogenesis, clinical signs, diagnosis and control measures of protozoan parasites belonging to the families: Trypanosomatidae, Monocercomonadidae, Trichomonadidae, Hexamitidae and Endamoebidae.

UNIT III

Morphology, epidemiology, pathogenesis, clinical signs, diagnosis and control measures of protozoan parasites belonging to the families: Eimeriidae, Cryptosporidiidae and Sarcocystidae.

UNIT IV

Morphology, epidemiology, pathogenesis, clinical signs, diagnosis and control measures of protozoan parasites belonging to the families: Plasmodiidae, Babesiidae, Theileriidae, Haemogregarinidae and Balantidiidae.

UNIT V

Morphology, epidemiology, pathogenesis, clinical signs, diagnosis and control measures of Rickettsiales like *Anaplasma*, *Ehrlichia* and *Haemobartonella*.

Practical

Identification of protozoan parasites and observation on parasite stages in host tissues and the attendant pathological lesions. Diagnosis of protozoan parasites of veterinary importance.

Suggested Readings

- Bhatia BB & Shah HL. 2000. *Protozoa and Protozoan Diseases of Domestic Livestock*. ICAR.
- Bhatia BB. 2000. *Textbook of Veterinary Protozoology*. ICAR.
- Dobbelaere DAE & McKeever D. 2002. *Theileria*. Springer Verlag.
- Dubey JP & Beattie CP. 1988. *Toxoplasmosis of Animals and Man*. CRC Press.
- Dubey JP, Speer CA & Fayer R. 1989. *Sarcocystosis of Animals and Man*. CRC Press.
- Dubey JP, Speer CA & Fayer R. 1990. *Cryptosporidiosis in Man and Animals*. CRC Press.
- Kreier JP. 1991-95. *Parasitic Protozoa*. Ed. JR Baker. Academic Press.
- Levine ND. 1985. *Veterinary Protozoology*. Iowa State Univ. Press.
- Lindsay DS & Weiss LM. 2004. *Opportunistic Infections :Toxoplasma Sarcocystis and Microsporidia*. Kluwer Academic Press.
- Maudlin I. 2004. *The Trypanosomiases*. Oxford Univ. Press.
- Sterling CR. and Adam RD. 2004. *The Pathogenic Enteric Protozoa*. Kluwer Academic Press.
- Thompson A. 2003. *Cryptosporidium*. Elsevier

VPA 605

PARASITOLOGICAL TECHNIQUES

0+2

Objective

To impart practical knowledge on various techniques used in veterinary parasitology.

Practical

Microscopy, micrometry, camera lucida drawings, micro- and digital photography.

Collection, processing and examination of faecal and blood samples; lymph node biopsies, skin scrapings and nasal washings from animals for parasitological findings. Quantitative faecal examination.

Evaluation of the efficacy and resistance of drugs against parasites.

Maintenance of tick and fly colonies in laboratory for experimental purposes and testing of drugs; tick dissection for vector potential. Collection of aquatic snails from field and their examination for the presence of different parasitic stages.

Collection, fixation, staining, whole mounts and identification of parasites.

Cryopreservation of parasites, culturing techniques for important parasites and pasture larval count, worm count and assessment of worm burden.

Remote sensing (RS) and geographic information system (GIS) as tools for mapping parasitic diseases.

Suggested Readings

- Chaudhri SS & Gupta SK. 2003. *Manual of General Veterinary Parasitology*. International Book Distr. Co.
- Durr P & Gatrell A. 2004. *GIS and Spatial Analysis in Veterinary Science*. CABI.
- Ministry of Agriculture, Fisheries and Food (MAFF). 1986. *Manual of Veterinary Parasitological Laboratory Techniques*. 3rd Ed. Tech. Bull. 18, HMSO.
- Rathore VS & Sengar YS. 2005. *Diagnostic Parasitology*. Pointer Publ.

VPA 606 CLINICAL PARASITOLOGY 1+1 Objective

Collection and examination of clinical material for parasitological investigations and study of clinical cases.

Theory

UNIT I

History, clinical signs, gross and microscopic examination of secretions and excretions of clinical cases.

UNIT II

Collection and dispatch of material to laboratory for diagnosis.

UNIT III

Animal sub-inoculation tests; blood and biopsy smear examination; histopathology of affected organs.

Practical

Identification, observation of parasitic stages in host tissues, excretions, secretions and associated pathological lesions.

Suggested Readings

- Faust EC, Russell PF & Jung RC. 1971. *Craig and Faust's Clinical Parasitology*. Lea & Febiger.
- Sloss MW, Kemp RL & Zajac AM. 1994. *Veterinary Clinical Parasitology*. Indian Ed. International Book Distr. Co.
- Soulsby E.J.L. 1965. *Textbook of Veterinary Clinical Parasitology*. Blackwell.

VPA 607

TRENDS IN CONTROL OF LIVESTOCK AND POULTRY PARASITES 1+1

Objective

To learn about integrated approach for the control of helminths, arthropods and protozoan parasites of veterinary importance.

Theory

UNIT I

Conventional and novel methods of control of helminth – anthelmintics, their mode of action, characteristic of an ideal anthelmintic, anthelmintic resistance, spectrum of activity, delivery devices, integrated control method and immunological control Formulation of deworming schedule. Snail and other intermediate host control.

UNIT II

Conventional and novel methods of control of protozoan parasites – antiprotozoan drugs, their mode of action, integrated control method and immunological control.

UNIT III

Conventional and novel methods of control of insects – Insecticides / acaricides - methods of application, their mode of action, insecticide resistance , integrated control method and immunological control.

Practical

In vivo and *in vitro* detection of efficacy of and resistance to parasitocidal agents.

Suggested Readings

- Kaufmann J. 1996. *Parasitic Infections of Domestic Animals*. Birkhauser Verlag.

Mehlhorn H (Ed). 2001. *Encyclopedic Reference of Parasitology: Diseases, Treatment, Therapy*. Springer Verlag.

VPA 608

IMMUNOPARASITOLOGY

2+1

Objective

To impart knowledge about the immunology, immunodiagnosis and immunoprophylaxis of ecto- and endoparasites of veterinary importance.

Theory

UNIT I

Introduction, types of parasitic antigens and their characterization.

UNIT II

Types of immunity in parasitic infections. Cellular and humoral immunity to parasites, hypersensitivity, regulation of the immune response.

UNIT III

Evasion of immunity, immunomodulations and their uses.

UNIT IV

Immune responses in helminths, arthropods and protozoa of veterinary importance.

UNIT V

Immunodiagnostic tests and their techniques; application of biotechnological tools in the diagnosis and control of parasitic diseases.

UNIT VI

Vaccines and vaccination against parasitic infections.

UNIT VII

Genetic control of parasites.

Practical

Preparation of various antigens (somatic, secretory and excretory) and their fractionation and characterization; raising of antisera and demonstration of various immunodiagnostic methods for the diagnosis of parasitic infections.

Suggested Readings

Behnkey JM. 1990. *Parasites, Immunity and Pathology*. Taylor & Francis.

Boothroyd JC & Komuniecki R. 1995. *Molecular Approaches to*

Cohen S & Sadun EH. 1976. *Immunology of Parasitic Infections*. Blackwell.

Cox FEG. 1993. *Modern Parasitology*. Blackwell.

Marr JJ, Nilsen TW & Komuniecki RW. 2003. *Molecular Medical Parasitology*. Elsevier.

Parasitology. Wiley-Liss Publication, New York.

Waklin D. 1996. *Immunity to Parasites*. Cambridge University Press.

VPA 609

PARASITIC ZONOSSES

2+0

Objective

To provide the students with an in-depth knowledge of occurrence and importance of parasitic zoonoses and how these parasites are diagnosed and controlled.

Theory

UNIT I

Introduction to the concept of zoonotic infections, definitions, various classifications of zoonoses, host-parasite relationships, modes of infections, factors influencing prevalence of zoonoses.

UNIT II

A detailed study of transmission, epidemiology, diagnosis and control of major protozoa of zoonotic importance.

UNIT III

A detailed study of transmission, epidemiology, diagnosis and control of major helminths of zoonotic importance.

UNIT IV

A detailed study of transmission, epidemiology, diagnosis and control of major arthropods of zoonotic importance.

Suggested Readings

Miyazaki 1991. *Helminthic Zoonoses*. International Medical Foundation of Japan.

Palmer SR, Soulsby EJJ & Simpson DIH. 1998. *Zoonoses*. Oxford

Parija SC. 1990. *Review of Parasitic Zoonoses*. AITBS Publ. Rathore

VS.2005. *Parasitic Zoonoses*. Pointer Publishers. Shakespeare M.

2002. *Zoonoses*. Pharmaceutical Press.

University Press.

VPA 610

PARASITES OF ZOO AND WILD ANIMALS

2+1

Objective

To learn about biological and control aspects of parasitic diseases of zoo and wild animals.

Theory

UNIT I

A detailed study of major protozoa of zoo and wild animals with particular emphasis on morphological features, geographical distribution, epidemiology, diagnosis and management.

UNIT II

A detailed study of major arthropod parasites of zoo and wild animals with particular emphasis on morphological features, geographical distribution, epidemiology, diagnosis and management.

UNIT III

A detailed study of major helminth parasites of zoo and wild animals with particular emphasis on morphological features, geographical distribution, epidemiology, diagnosis and management.

Practical

Methods for investigating parasitic diseases in wild animals. Collection of parasites at post-mortem. Identification and quantification of parasites. Visit to Zoo and Wild Life Parks/ Sanctuaries.

Suggested Readings

Chowdhury N & Alonso Aquirre A. 2001. *Helminths of Wild Life*.

Friend M & Franson JC. 1999. *Field Manual of Wildlife Diseases: General Field Procedures and Diseases of Birds*. Free of charge at: www.nwhc.usgs.gov/publications/field_manual/field_manual_of_wildlife_diseases.pdf

NBII Wildlife Diseases Information Node can be reached at: <http://wildlifediseases.nbii.gov>

Oxford & IBH Publishing Co. Pvt. Ltd.

Samual W, Pybus M & Kocan A. (Eds). 2001. *Parasitic Diseases of Wild Mammals*. Iowa State Univ. Press.

Objective

To learn about the details of various snails involved in diseases transmission.

TheoryUNIT I

Characters and classification of Mollusca.

UNIT II

Occurrence, distribution, ecology, life history, morphology and control of vector snails belonging to families, Planorbidae, Lymnaeiidae, Thiridae, Amnicolidae, Helicidae, Succineidae and Zonitidae.

Unit III

Examination of vector molluscs for parasitic infections.

Unit IV

Haematology, internal defense mechanisms, parasite-induced pathology and molluscan tissue culture.

Practical

Collection and identification of vector molluscs, study of their shells and internal organs. Breeding, rearing and maintenance of vector molluscs in the laboratory. Examination of molluscs for various developmental stages of parasites.

Suggested Readings

Malek EA & Cheng TC. 1974. *Medical and Economic Malacology*. Academic Press.

Sturm CF, Pearce TA & Valdés A. 2006. *The Mollusks: A Guide to Their Study, Collection and Preservation*. American Malacological Society, Pittsburgh and Universal Publishers, Boca Raton.

Suggested Broad Topics for Master's Research

- * Detection and management of antiparasitic drug resistance
- * Studies on the efficacy of medicinal plants/herbal preparations against various parasites affecting domestic animals and poultry and the effect of these plants on pathogenicity and immunology of parasites
- * Development of immunoprophylactic measures and immunodiagnostic techniques using modern molecular and biotechnological based tools for important parasitic diseases prevalent in the state
- * Application of remote sensing and GIS for the management of parasitic diseases.
- * Studies on application of host's resistance as a part of integrated parasite management programme.

7. VETERINARY PATHOLOGY

Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
VPP 601	GENERAL PATHOLOGY	2+1
VPP 602	TECHNIQUES IN PATHOLOGY	1+1
VPP 603	ANIMAL ONCOLOGY	1+1
VPP 604	CLINICAL PATHOLOGY	1+2
VPP 605	NECROPSY PROCEDURES AND INTERPRETATIONS –I	0+1
VPP 606	NECROPSY PROCEDURES AND INTERPRETATIONS –II	0+1
VPP 607	SYSTEMIC PATHOLOGY	2+1
VPP 608	PATHOLOGY OF INFECTIOUS DISEASES OF DOMESTIC ANIMALS	2+1
VPP 609	TOXICOPATHOLOGY	2+1
VPP 610	AVIAN PATHOLOGY	2+1
VPP 611	PATHOLOGY OF LABORATORY ANIMALS, FISH AND WILD ANIMALS	2+1
VPP 612	VETEROLEGAL PATHOLOGY	1+0
VPP 691	MASTER’S SEMINAR	1+0
VPP 699	MASTER’S RESEARCH	20

Major Subject	Minor Subjects
Veterinary Pathology	Veterinary Microbiology, Veterinary Anatomy, Veterinary Medicine, , Veterinary Parasitology, Veterinary Pharmacology & Toxicology, Animal Nutrition

- The choice of minor courses other than those listed above, may be allowed on the recommendations of advisory committee, if essentially required as per the research problem, with the concurrence of Head of the department and Dean post graduate studies

VETERINARY PATHOLOGY

Course Contents

VPP 601 **GENERAL PATHOLOGY** **2+1**

Objective

To acquaint students with different types of degenerations, cell injuries caused by different types of irritants and inflammation.

Theory

UNIT I

Introduction and history of pathology, principles of pathology including etiology, course and termination of disease.

UNIT II

Advanced study of various degenerations, infiltrations, necrosis, endogenous and exogenous pigmentations.

UNIT III

Circulatory and growth disturbances. Reversible and irreversible cell injury.

UNIT IV

Inflammation including vascular and cellular alterations with emphasis on chemical mediators. Hypersensitivity and immune mediated mechanisms, Mechanism of healing and fever.

Practical

To study the gross and microscopic changes in degenerations, infiltrations, pigmentations, circulatory and growth disturbances and different types of necrosis in different tissues of domestic animals. Study of gross and histopathological features of different types of inflammation.

Suggested Readings

McGavin MD & Zachary JF. 2006. *Pathologic Basis of Veterinary Diseases*. 4th Ed. Elsevier

Vegad JL. 2007. *Text Book of Veterinary General Pathology*. 2nd Ed. International Book Distr.

VPP 602 **TECHNIQUES IN PATHOLOGY** **1+1**

Objective

To acquaint students with different techniques used frequently in Veterinary Pathology.

Theory

UNIT I

Basic histopathological techniques, collection of tissues, fixation, processing and section cutting, staining by routine and special methods.

UNIT II

Principles of dark ground, phase contrast and fluorescent microscopy and micrometry.

UNIT III

Histochemical techniques for demonstration of fat, glycogen and fibrous connective tissue, mucopolysaccharides and common enzymes.

Practical

Collection of tissues for histopathological, histochemical, toxic, bacterial and viral examination. Use of different fixatives for preservation of museum specimens. Application of different techniques- histopathological, cryosectioning, micrometry, routine and special staining. Demonstration of different inclusions, bacteria and fungi in tissues. Histochemical techniques to demonstrate different tissue constituents.

Suggested Readings

Culling CFA. 1969. *Handbook of Histological Techniques*. Butter Worths.
Lillie RD. 1965. *Histopathologic Techniques and Practical Histo-chemistry*. 3rd Ed. McGraw-Hill.

VPP 603

ANIMAL ONCOLOGY

1+1

Objective

To acquaint students with different types of neoplasms of domestic animals, their nature, cause, pathology and diagnosis.

Theory

UNIT I

Study of different neoplasms of animals including their identification, and epidemiology.

UNIT II

Etiology, histogenesis and experimental production.

UNIT III

Tumour immunology, cell cultures, transplantation and biological behaviour.

Practical

To study the gross and microscopic changes in different types of neoplasms.

Suggested Readings

Meuten DJ. 2002. *Tumors in Domestic Animals*. 4th Ed. Blackwell.

VPP 604

CLINICAL PATHOLOGY

1+2

Objective

To acquaint students with clinical alterations in blood, urine, CSF and other body fluids due to different diseases.

Theory

UNIT I

Study of changes in blood, urine, faeces, cerebrospinal fluid and biopsy specimens and their interpretation.

UNIT II

Exfoliative cytology, organ function tests and their interpretation.

UNIT III

Biochemical profile of blood/plasma/serum and its correlation with disease conditions in domestic animals.

Practical

Evaluation of laboratory investigations on blood, urine, faeces and biopsy specimens from natural and experimentally produced disease conditions.

Suggested Readings

Benzamin MM. 1978. *Outline of Veterinary Clinical Pathology*. 3rd Ed. Iowa State Univ. Press.
Coles EH. 1967. *Veterinary Clinical Pathology*. WB Saunders.

VPP 605 **NECROPSY PROCEDURES AND INTERPRETATIONS-1** **0+1**

Objective

To acquaint students with different Post-mortem procedures in large animals and study of PM lesions in different diseases.

Practical

Detailed necropsy examination of various species of farm animals, laboratory animals and wildlife. Necropsy case presentation and report writing/protocol preparation. Collection of specimens for diagnosis of viral, bacterial, protozoan, parasitic diseases, toxic/ poisoning and for histochemistry/histopathology. Systemic examination of brain, lungs, heart, endocrine glands, lymph nodes, liver, Gastro Intestinal tract, urinary and genital systems for gross pathological and histopathological studies and correlation of the observations to diagnose the disease conditions.

Suggested Readings

Jones TC & Gleiser CA. 1954. *Veterinary Necropsy Procedures*. JB Lippincott.

VPP 606 **NECROPSY PROCEDURES AND INTERPRETATIONS-II** **0+1**

Objective

To acquaint students with different Post-mortem procedures in small animals and poultry and study of PM lesions in different diseases.

Practical

Detailed necropsy examination of various species of small animals, poultry, laboratory animals and wildlife. Necropsy case presentation and report writing/protocol preparation. Collection of specimens for diagnosis of viral, bacterial, protozoan, parasitic diseases, toxic/ poisoning and for histochemistry/histopathology. Systemic examination of brain, lungs, heart, endocrine glands, lymph nodes, liver, Gastro Intestinal tract, urinary and genital systems for gross pathological and histopathological studies and correlation of the observations to diagnose the disease conditions.

Suggested Readings

Jones TC & Gleiser CA. 1954. *Veterinary Necropsy Procedures*. JB Lippincott.

VPP 607 **SYSTEMIC PATHOLOGY** **2+1**

Objective

To teach the students about the different disease conditions of haemopoietic, circulatory, respiratory, digestive, urinary and genital systems, nervous, musculoskeletal, endocrine, glands and special senses.

Theory

UNIT I

An advanced study of pathological conditions affecting different organs of haemopoietic (bone marrow, blood, spleen, lymph node), circulatory (heart, blood vessels and lymph vessels). Respiratory (nasal cavity, larynx, trachea, bronchi, lung and pleura) systems. Study of etiology, pathology and pathogenesis of specific infectious and non-infectious diseases of domestic animals related to the above mentioned systems

UNIT II

Advanced study of pathological conditions affecting different organs of digestive (buccal cavity, pharynx, oesophagus, stomach and intestines)

urinary (kidneys, ureter, urinary bladder and urethra) and genital (male and female organs including mammary gland) systems. Study of etiology, pathology and pathogenesis of specific infectious and non-infectious diseases of domestic animals related to the above mentioned systems.

UNIT III

Advanced study of pathological conditions affecting different organs of nervous (brain and spinal cord), endocrine (pituitary, thyroid, parathyroid, pancreas), musculo-skeletal systems (muscles and bones), and organs of special senses (eye, ear), skin and its appendages (hoof, tail). Study of etiology, pathology and pathogenesis of specific infectious and non-infectious diseases of domestic animals related to the above mentioned systems/organs.

Practical

To study the gross and histopathological changes in important conditions affecting various systems. Study of gross and microscopic lesions in specific diseases pertaining to above said systems.

Suggested Readings

Jubb KVF & Kennedy PC. 2005. *Pathology of Domestic Animals*. Academic Press.

VPP 608	PATHOLOGY OF INFECTIOUS DISEASES OF DOMESTIC ANIMALS	2+1
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Objective

To teach the students about the important infectious disease conditions of domestic animals

Theory

UNIT I

Pathology of various viral diseases of domestic animals.

UNIT II

Pathology of various bacterial and fungal diseases of domestic animals.

UNIT III

Pathology of various rickettsial and parasitic diseases of domestic animals.

Practical

To study the slides, museum specimens including autopsy specimens concerned with specific diseases.

Suggested Readings

Jones TC, Hunt RD & King NW 1997. *Veterinary Pathology*. Blackwell Publishing.

Jubb KVF & Kennedy PC 2005. *Pathology of Domestic Animals*. Academic Press.

VPP 609	TOXICOPATHOLOGY	2+1
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Objective

To teach students about toxicity in livestock due to plants and extraneous poisons.

Theory

UNIT I

Introduction, mode of action, diagnosis and treatment of different poisons and their classification.

UNIT II

Pathogenesis, gross and microscopic pathology of diseases caused by toxic plants, organic and inorganic poisons commonly taken or administered maliciously to different species of domestic animals.

Practical

To study gross and histopathological alterations as a result of ingestion of toxic plants and extraneous poisons in domestic animals.

Suggested Readings

Jones TC, Hunt RD & King NW 1997. *Veterinary Pathology*. Blackwell Publishing.

VPP 610

AVIAN PATHOLOGY

2+1

Objective

To teach the students about the different disease conditions of poultry including pathology and diagnosis.

Theory

UNIT I

Pathology of infectious diseases of chickens, turkeys, ducks and other birds.

UNIT II

Pathology of non-infectious diseases of chickens, turkeys, ducks and other birds.

Practical

Necropsy examination of the different species of poultry; study of gross and histopathological lesions in naturally occurring and artificially produced diseases of birds.

Suggested Readings

Calnek BW. 1991. *Diseases of Poultry*. 9th Ed. Iowa State Univ. Press.
Saif YM, Barnes FJ, Glisson JR, Fadly AM, Mc Dougald LR & Swayne D. 2008. *Diseases of Poultry*. 11th Ed. Blackwell Publishing.

VPP 611

PATHOLOGY OF LABORATORY ANIMALS, FISH AND WILD ANIMALS

2+1

Objective

To teach the pathology and diagnosis of different disease conditions of laboratory animals, fish and wild animals.

Theory

UNIT I

Introduction, disease transmission and inter-phase.

UNIT II

Pathology of important infectious diseases (viz. bacterial, viral, fungal and parasitic) of fish, laboratory and wild/zoo animals.

UNIT III

Pathology of non-infectious diseases of fish, lab/ wild/zoo animals.

Practical

Post-mortem examination of wild animals including wild birds. Study of gross and microscopic lesions of important infectious and non - infectious diseases of fish and laboratory animals.

Suggested Readings

Arora BM. 1984. *Wildlife Diseases in India*. Periodical Expert Book Agency.

Fowler ME. 1978. *Zoo and Wild Animal Medicine*. WB Saunders.
Beninchka K, Garner FM & Jones TC. 1978. *Pathology of Laboratory Animals* (Vols. I, II). Springer Verlag.
Roberts RJ. 1979. *Fish Pathology*. Bailliere Tindall, London.

VPP 612

VETEROLEGAL PATHOLOGY

1+0

Objective

To educate the students about common veterolegal problems and legal writing of PM report.

Theory

UNIT I

General knowledge about the laws relating to veterinary practice, professional discipline and professional etiquettes.

UNIT II

Regulations dealing with diseases of animals in India regarding epidemiology, quarantine certificate, issue of soundness certificate etc.

UNIT III

Common causes of violent death, criminal assault, cruelty to animals, malicious poisoning, snake bite, electrocution, gun shot wounds, automobile accidents, doping etc.

Suggested Readings

Gahlot AK, Sharma SN & Tanwar RA. 2003. *Veterinary Jurisprudence*. 5th Ed. NBS Publishers, Bikaner.

Jones TC & Gleiser CA. 1954. *Veterinary Necropsy Procedures*. JB Lippincott.

Lincoln PJ & Thomson J. 1998. *Forensic DNA Profiling Protocols*. Humana Press.

Rudin N & Inman K. 2002. *An Introduction to Forensic DNA Analysis*. CRC Press.

Suggested Broad Topics for Master's Research

- * Effect of probiotics on pathogenesis and pathology of bacterial diseases
- * Effect of antioxidants on pathogenesis and pathology of bacterial diseases
- * Pathology of mixed infections in domestic animals
- * Role of stress in pathogenesis and pathology of animal diseases

8. VETERINARY PUBLIC HEALTH

Course Structure- at a Glance

CODE	COURSE TITLE	CREDITS
VPH 601	ELEMENTS OF VETERINARY PUBLIC HEALTH	1+1
VPH 602	BACTERIAL AND RICKETTSIAL AGENTS OF PUBLIC HEALTH SIGNIFICANCE	2+1
VPH 603	VIRAL, FUNGAL AND PARASITIC AGENTS OF PUBLIC HEALTH SIGNIFICANCE	2+1
VPH 604	ZOONOSES, EPIDEMIOLOGY AND PUBLIC HEALTH	2+1
VPH 605	PRINCIPLES OF FOOD HYGIENE AND SAFETY	2+1
VPH 606	FOOD-BORNE INFECTIONS AND INTOXICATIONS	2+1
VPH 607	MEAT AND MILK HYGIENE	2+1
VPH 608	ENVIRONMENTAL POLLUTION AND SAFETY	3+1
VPH 609	FISH, FISH PRODUCTS AND SEAFOOD HYGIENE	1+1
VPH 610	BIOTERRORISM AND DISASTER MANAGEMENT	1+1
VPH 691	MASTER'S SEMINAR	1+0
VPH 699	MASTER'S RESEARCH	20

Major Subject	Minor Subjects
Veterinary Public Health	Veterinary Microbiology, Veterinary Pathology, Animal Biotechnology, Veterinary Pharmacology & Toxicology, Veterinary Parasitology, Livestock Product Technology

- The choice of minor courses other than those listed above, may be allowed on the recommendations of advisory committee, if essentially required as per the research problem, with the concurrence of Head of the department and Dean post graduate studies

VETERINARY PUBLIC HEALTH

Course Contents

VPH 601 ELEMENTS OF VETERINARY PUBLIC HEALTH 1+1 Objective

To acquaint students with basics of veterinary public health.

Theory

UNIT I

The purposes and scope of veterinary public health; veterinary interests in public health, principal functions and fields of activity of public health veterinarians.

UNIT II

Definition of veterinary public health administration; organisation, administration and implementation of veterinary public health services and programmes.

UNIT III

Public health team, administration and functions; place of veterinarian in the public health team; veterinary public health agencies and institutions in India and abroad.

Practical

Collection of information about set up of veterinary public health in different countries.

Suggested Readings

- Schwabe CW. 1969. *Veterinary Medicine and Human Health*. Williams & Wilkins.
- Sherikar AT, Bachchil VN & Thapliyal DC. 2004. *Textbook of Elements of Veterinary Public Health*. ICAR.

VPH 602 **BACTERIAL AND RICKETTSIAL AGENTS OF PUBLIC HEALTH SIGNIFICANCE** 2+1

Objective

To impart knowledge about importance and characteristic features of bacterial and rickettsial pathogens of public health significance.

Theory

UNIT I

Importance of microbes in relation to veterinary public health; cultural, biochemical and other identification characters; ecology, transmission and survivability of bacteria in nature.

UNIT II

Description of *Bacillus*, *Listeria*, *Mycobacterium*, *Clostridium*, *Staphylococcus*, *Enterococcus*, *Brucella* and *Leptospira*

UNIT III

Description of *Vibrio*, *Salmonella*, *Escherichia*, *Campylobacter*, *Yersinia*, *Lactobacillus*, *Pseudomonas* and *Micrococcus*.

UNIT IV

Description of *Coxiella*, *Rickettsia* and *Chlamydia*.

Practical

Isolation and identification methods for important bacterial and rickettsial agents of public health significance from host, vehicle and environment.

Suggested Readings

Holt JG, Krieg NR, Sneath PHA, Staley JT & Williams ST. 1994. *Bergey's Manual of Determinative Bacteriology*. Williams & Wilkins.

VPH 603 VIRAL, FUNGAL AND PARASITIC AGENTS OF PUBLIC HEALTH SIGNIFICANCE 2+1

Objective

To impart knowledge about importance and characteristic features of viral, fungal and parasitic pathogens of public health significance.

Theory

UNIT I

Systematic study of viral agents of Japanese encephalitis, encephalomyelitis, rabies, influenza, KFD, Rift valley fever, and enteroviruses; their morphological and other characters, ecology, transmission and survivability in nature.

UNIT II

Description of fungal agents of public health importance belonging to genera: *Aspergillus*, *Penicillium*, *Fusarium*, *Mucor*, *Histoplasma*, *Microsporum*, *Trichophyton* and *Sporotrichum*.

UNIT III

Description of parasites of public health importance: *Taenia*, *Echinococcus*, *Trichinella*, *Toxoplasma*, *Diphyllobothrium*, *Fasciola*, and *Cryptosporidium*.

Practical

Isolation and identification methods for important fungal, viral and parasitic agents of public health significance from host, vehicle and environment.

Suggested Readings

Ananthanarayan R & Panikar J. 1997. *Textbook of Microbiology*. Orient Longman.
Pathak KML. 1991. *Fundamentals of Parasitic Zoonoses*. Kalyani.

VPH 604 ZOONOSES, EPIDEMIOLOGY AND PUBLIC HEALTH 2+1

Objective

To impart knowledge of epidemiology, prevention and control of important zoonotic diseases.

Theory

UNIT I

Concept and classification of zoonoses; comprehensive description of etiology, host range, epidemiology, diagnosis and management of zoonotic diseases. Epidemiology- Definition, scope. Principles of investigation of outbreak. Formulation and Evaluation of hypothesis, epidemiological studies. Biotic community, ecosystem, parasitic host relation. Natural foci of diseases. Patterns and trends of disease occurrence – endemic, epidemic, pandemic, seasonal, periodic and cyclic trends. Measurement of health and diseases – morbidity & mortality. Principle of control of communicable and non- communicable diseases.

UNIT II

Bacterial diseases: anthrax, brucellosis, tuberculosis, salmonellosis, yersiniosis, leptospirosis, listeriosis, plague, tularaemia, glanders, malidiosis, staphylococcosis, streptococcosis, tetanus, botulism, infections due to *Clostridium perfringens*, *E. coli*, *Aeromonas hydrophilla*, *Bacillus cereus*, *Vibrio parahaemolyticus*, cat scratch disease, chlamydiosis, Lyme disease, borreliosis (relapsing fever).

UNIT III

Detailed description of viral zoonoses: food-borne viruses viz. rota, tick-borne encephalitis, FMD, hepatitis A & E, Norwalk, entero, parvo, adeno,

cytomegalo, astro, calci and corona viruses, influenza, rabies, vector-borne viruses viz. Japanese encephalitis, Kyasanur forest disease, chickengunya, Crimean-Congo haemorrhagic fever, dengue fever, West-Nile viruses, yellow fever, rift -valley fever, equine encephalitis, louping ill, and some rare and potential zoonotic viruses such as Newcastle and pox viruses.

UNIT IV

Q fever and other rickettsiosis, fungal infections viz. dermatophytosis, blastomycosis, coccidioidomycosis, cryptococcosis, histoplasmosis, aspergillosis, candidiasis, rhinosporidiosis and sporotrichosis. Attributes and impact of parasitic zoonoses; description, etiology, host range, epidemiology, diagnosis and disease management of echinococcosis, taeniasis and cysticercosis, toxoplasmosis, trichinellosis, cryptosporidiosis, dracunculosis, fasciolopsiosis, sarcocystosis, liver fluke diseases, cutaneous and visceral larva migrans, schistosomiasis, leishmaniasis, trypanosomosis.

Practical

Isolation and identification of zoonotic agents, diagnostic procedures of zoonotic diseases, Calculation of different rates and ratios in epidemiology, Evaluation of medicine and vaccine in a population, Field visit and demographic studies.

Suggested Readings

Thapliyal DC. 1999. *Diseases of Animals Transmissible to Man*. International Book Distr. Co.

VPH 605 PRINCIPLES OF FOOD HYGIENE AND SAFETY 2+1

Objective

To acquaint the students about principles of food hygiene and quality improvement practices.

Theory

UNIT I

Relation between veterinary public health and food hygiene; concept of food hygiene, impact of environmental sanitation and other factors on food quality.

UNIT II

Food spoilage, safety and preservation methods.

UNIT III

Microbiological standards and quality control (biological and other indicators of hygienic quality and spoilage) of foods to prevent food-borne infections.

UNIT IV

General principles of prevention of food-borne illnesses, GMP, HACCP, risk analysis.

Practical

Procedures of evaluation of hygienic/microbiological quality of raw and processed foods especially of animal origin by detection of biological and other indicators.

Suggested Readings

Jay JM. 1996. *Modern Food Microbiology*. CBS.

VPH 606 FOOD-BORNE INFECTIONS AND INTOXICATIONS 2+1 Objective

To impart knowledge about major illnesses due to foods.

Theory

UNIT I

Food-borne bacterial infection and intoxications due to *Salmonella*, *Campylobacter*, *Clostridium*, *Staphylococcus*, *Listeria*, *Vibrio*, *E. coli*, *Bacillus cereus*, bacterial toxins.

UNIT II

Food-borne viral infections: infectious hepatitis, poliomyelitis, gastroenteritis etc, natural toxic substances in foods.

UNIT III

Health problems due to food additives, biocides, bacterial toxins.

UNIT IV

Heavy metals, antibiotics, hormones etc. in food.

Practical

Detection and quantitation of food-borne pathogens, toxins, antibiotics, pesticides and additives in foods.

Suggested Readings

Jay JM. 1996. *Modern Food Microbiology*. CBS.

VPH 607 MEAT AND MILK HYGIENE 2+1

Objective

To educate regarding general methods of food hygiene.

Theory

UNIT I

Principles of food hygiene with special reference to foods of animal origin, human health and economics, nature and problem of food supply in India.

UNIT II

Meat hygiene and public health, abattoir hygiene.

UNIT III

Milk hygiene and public health, in place cleaning.

UNIT IV

Egg, food legislation, meat and milk adulteration.

Practical

Milk and meat inspection, quality control tests of meat, milk and fish.

Suggested Readings

Gracey JF, Collins DS & Huey RJ. 1999. *Meat Hygiene*. WB Saunders.

WHO. 1962. *Milk Hygiene*. WHO.

Jay JM. 1996. *Modern Food Microbiology*. CBS.

VPH 608 ENVIRONMENTAL POLLUTION AND SAFETY 3+1

Objective

To impart education about pollutants in the environment and control.

Theory

UNIT I

Introduction to environmental hygiene, environment and health, microbial aspects of pollution.

UNIT II

Soil pollution, air pollution, water pollution and health.

UNIT III.

Genetic risk from environmental agents, health problems from nuclear energy and radiation pollution, environmental estrogens and pesticides-pollution.

UNIT IV

Dissemination of excreted pathogens, animal-waste and human risk, principles of safe disposal of waste.

UNIT V

Heavy metals, pesticides, veterinary drug residues and human health.

Practical

Determination of potability of drinking water, estimation and detection of pathogenic microbes in water, air, soil, animal products, sewage, and animal waste, inspection of sewage and waste disposal plants/sites.

Suggested Readings

Trieff NM. 1980. *Environment and Health*. Ann Arbor Science Publ.

VPH 609 FISH, FISH PRODUCTS AND SEAFOOD HYGIENE 1+1

Objective

To impart knowledge regarding fish hygiene and fish borne diseases

Theory

UNIT I

Fisheries and resources, fish preservation, hygienic quality control

UNIT II

Hygienic disposal and utilization of byproducts of fish, hygienic handling, transportation and marketing of fish.

UNIT III

Fish borne diseases in relation to human health.

Practical

Study of physical and biological indicators of wholesome fish to determine hygienic status of raw and processed fish. Residue analysis in fish.

Suggested Readings

Nollet Leo ML (Ed.). 2007. *Handbook of Meat, Poultry and Seafood Quality*. Blackwell publishing, Oxford.

VPH 610 BIOTERRORISM AND DISASTER MANAGEMENT 1+1

Objective

To update knowledge of disaster, biological weapons, biological hazards and remedial measures bioterrorism and biomedical hazards and their prevention

Theory

UNIT I:

Natural and man made disaster, impact analysis and classification of disaster scale, essential preparations to manage disaster, role and sequence of emergency medical services by veterinarians.

UNIT II

Effect of natural disasters like floods, prolonged draughts, forest fires, earthquakes, sunami and tidal damages, storms etc. on animal population both domestic and wild, post-disaster disease susceptibility, emergency control and remedial measures.

UNIT III

Biomedical hazards and biosafety, occupational health risk management. Major agents and their characteristics which have been used in the past and those which can be used in future as biological weapons.

UNIT IV

Biological weapons, hazard analysis and combating bioterrorism. Bio-ethics and social ethics, advisory role of veterinarians.

Practical

Detection of biohazards during disaster, detection and characterization of various organisms used as biological agents, use of disinfectants for their destruction.

Suggested Readings

Singh SK. 1998. *Disaster Management*. Mittal Publications, New Delhi.

Suggested Broad Topics for Masters Research

- * Prevention and control of emerging and re-emerging food-borne infections and intoxications
- * Prevention and control of major zoonotic diseases of local importance
- * Environmental pollution and health problems
- * Food safety, risk analysis
- * Shelf life
- * Food adulteration and food safety

9. ANIMAL GENETICS AND BREEDING

Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
AGB 601	ANIMAL CYTOGENETICS AND IMMUNOGENETICS	2+1
AGB 602	MOLECULAR GENETICS IN ANIMAL BREEDING	2+1
AGB 603	POPULATION AND QUANTITATIVE GENETICS IN ANIMAL BREEDING	2+1
AGB 604	SELECTION METHODS AND BREEDING SYSTEMS	3+1
AGB 605	BIOMETRICAL TECHNIQUES IN ANIMAL BREEDING	3+1
AGB 606	CONSERVATION OF ANIMAL GENETIC RESOURCES	2+0
AGB 607	CATTLE AND BUFFALO BREEDING	2+1
AGB 608	SMALL FARM ANIMAL BREEDING (SHEEP, GOAT, SWINE AND RABBIT)	2+0
AGB 609	POULTRY BREEDING	2+1
AGB 610	LABORATORY ANIMAL BREEDING	1+0
AGB 691	MASTER'S SEMINAR	1+0
AGB 699	MASTER'S RESEARCH	20

Major Subjects	Minor Subjects
Animal Genetics and Breeding	Animal Biotechnology, Statistics, Livestock Production and Management, Veterinary Gynecology & Obstetrics, Veterinary Physiology, Veterinary Biochemistry, Animal Nutrition.

Note: The choice of minor courses other than those listed above, may be allowed on the recommendations of advisory committee, if essentially required as per the research problem, with the concurrence of Head of the department and Dean post graduate studies.

ANIMAL GENETICS AND BREEDING

Course Contents

AGB 601 ANIMAL CYTOGENETICS AND IMMUNOGENETICS 2+1

Objective

To educate about basic principles of cytogenetics and immunogenetics and their applications in improving farm animals.

Theory

UNIT I

Development in animal cytogenetics and immunogenetics of farm animals. Immunoglobulins and their types: antigen-antibody interactions, Immune response, ELISA.

UNIT II

Major histocompatibility complex; genetics of biochemical variants and their applications; Ir-genes and concepts of disease resistance including major genes; hybridoma and its significance; concept of immuno-fertility, BoLA, BuLA, TLRs, Interleukins.

UNIT III

Chromatin structure of eukaryotes; chromosome number and morphology in farm animals banding and karyotyping; chromosomal and genetic syndromes, DNA packing in chromosomes, Z+B DNA, FISH chromosome painting and PRINS. RH Panel Mapping.

UNIT IV

Mutation and assays of mutagenesis; sister chromatid exchanges; recombinant DNA technique and its application in animal improvement programme.

Practical

Polymorphism of haemoglobulins, transferrins, enzymes/proteins; preparation of monovalent blood reagent-isoimmunization, titre testing and absorption of polyvalent serum; identification of bar bodies; in vitro and in vivo preparation of somatic metaphase chromosomes; screening of chromosomal abnormalities; microphotography and karyotyping; banding procedures for comparing the chromosomal complement, FISH and PRINS.

Suggested Readings

- Hare WCD & Elizabeth L Singh 1999. *Cytogenetics in Animal Reproduction*. CABI.
- Roitt I. 1997. *Essential Immunology*. Blackwell.
- Stine GJ. 1989. *The New Human Genetics*. Wm C Brown Publ.
- Summer AT & Chandley AC. 1993. *Chromosome Today*. Chapman & Hall.

AGB 602 MOLECULAR GENETICS IN ANIMAL BREEDING 2+1

Objective

To educate about molecular techniques to identify molecular markers as an aid to selection.

Theory

UNIT I

Basic concept: Genesis and importance of molecular techniques; Genome organization – physical and genetic map, current status of genome maps of livestock

UNIT II

Molecular markers and their application; RFLP, RAPD, Microsatellite/ Minisatellite markers, SNP marker, DNA fingerprinting

UNIT III

DNA sequencing, Genome sequencing, Genomic Library, Polymerase Chain Reaction (PCR), its types (PCR-RFLP, AS-PCR etc.) and applications; Transgenesis and methods of gene transfer

UNIT IV

Statistical techniques for analyzing molecular genetic data, Quantitative Trait Loci (QTL) mapping and its application in animal breeding, Genome scan, Candidate gene approach, Genomic selection, Marker Assisted Selection- basic concept

Practical

Extraction and purification of genomic DNA, Gel electrophoresis, Restriction enzyme digestion of DNA and analysis, PCR, PCR-RFLP, PCR-SSCP, Bioinformatics tool for DNA sequence analysis, Design of primer, Isolation of RNA, cDNA synthesis, Statistical methods for analyzing molecular genetic data.

Suggested Readings

Akano IE 1992. *DNA Technology*. IAP Academic Press.

Micklos DA, Fryer GA & Crotty DA. 2003. *DNA Science*. Cold Spring Harbour.

Setlow JK. 2006. *Genetic Engineering – Principles and Methods*. Springer.

AGB 603

POPULATION AND QUANTITATIVE GENETICS 2+1 IN ANIMAL BREEDING

Objective

To study genetic structure of animal population and importance of genetic variation and covariation among traits.

Theory

UNIT I

Individual versus population. Genetic Structure of population. Factors affecting changes in gene and genotypic frequencies and their effect on genetic structure of animal populations. Approach to equilibrium under different situations: Viz: Single autosomal locus with two alleles, single sex-linked locus, two pairs of autosomal linked and unlinked loci;

UNIT II

Small population: random genetic drift, effective population size, pedigreed populations, regular and irregular inbreeding systems.

UNIT III

Quantitative genetics-gene effects, population mean and variance and its partitioning, biometric relations between relatives.

UNIT IV

Genetic and phenotypic parameters-their methods of estimation, uses, possible biases and precision. Scale effects and threshold traits.

Practical

Problems relating to gene and genotypic frequencies under different conditions. Estimation of inbreeding in regular and irregular systems. Estimation of effective population size. Computation of quantitative genetic effects. Estimation of variance components. Computation of heritability, repeatability, genetic, environmental and phenotypic correlations and their standard errors.

Suggested Readings

Bulmer MG. 1980. *The Mathematical Theory of Quantitative Genetics*. Clarendon Press.

Crow JF & Kimura M. 1970. *An Introduction to Population Genetics. Theory*. Harper & Row.

Falconer DS & Mackay TFC 1996. *An Introduction to Quantitative Genetics*. Longman.

Jain JP. 1982. *Statistical Techniques in Quantitative Genetics*. Tata McGraw-Hill.

Pirchner F. 1981. *Population Genetics in Animal Breeding*. S. Chand.

AGB 604

SELECTION METHODS AND BREEDING SYSTEMS

3+1

Objective

To explain the methodology of selection and breeding systems for genetic improvement of livestock and poultry.

Theory

UNIT I

Type of selection and their genetic consequences. Response to selection and its prediction and improvement of response to selection.

UNIT II

Theoretical aspects of accuracy and efficiency of different base of selection. Prediction of breeding value using different criteria. Combined Selection. Correlated response to selection and efficiency of indirect selection.

UNIT III

Selection of several traits. Evaluation of short term and long term selection experiments viz: bidirectional selection and asymmetry of response, selection plateau and limit.

UNIT IV

Genetic aspects and consequences of various mating systems. Effects of mating systems on mean and variance. Application of various mating system in animal improvement. Selection for general and specific combining ability. Genetic polymorphism and its application in genetic improvement.

Practical

Estimation of breeding values from different sources of information. Prediction of direct and correlated response to different bases of selection. Computation of breeding values using different sources of information for female and male

selection. Computation of realized heritability and genetic correlation. Selection index: Computation, Accuracy and response in component traits. Estimation of heterosis for different types of crosses. Estimation of GCA and SCA

Suggested Readings

- Falconer DS & Mackay TFC. 1996. *An Introduction to Quantitative Genetics*. Longman.
- Jain JP. 1982. *Statistical Techniques in Quantitative Genetics*. Tata McGraw-Hill.
- Tomar SS 1996. *Text Book of Population Genetics*. Vol. I. *Qualitative Inheritance*; Vol. II. *Quantitative Inheritance*. Universal Publ.

AGB 605 BIOMETRICAL TECHNIQUES IN ANIMAL BREEDING 3+1

Objective

To educate about the various biometrical techniques for data analysis and their applications in animal breeding research.

Theory

UNIT I

Review of basic concepts in statistical inference and balanced experimental designs. Nature of structure of animal breeding data and sources of variation.

UNIT II

Introduction to matrix algebra, types of matrices and matrix operations. Determinants and their properties, methods of finding inverse of a matrix and their application

UNIT III

ANOVA, Regression and Correlations, Henderson's methods for estimation of variance components, Basic concepts of linear models, Least-squares analysis, maximum likelihood; Method of estimation; Generalized LS and weighted LS. Fisher's discriminant function and its application, D2 - Statistics in divergent analysis.

UNIT IV

Linear models in animal breeding, Methods of analysis of unbalanced animal breeding data. Adjustment of data. Data base management and use of software packages in animal breeding.

Practical

Matrix applications, determinant and inverse of matrices; Building of models for various types of data; Estimation of variance components; Least squares method for analysis of research data; Collection, compilation, coding, transformation and analysis of animal breeding data by using above biometrical techniques with computer application.

Suggested Readings

- Henderson CR. 1984. *Application of Linear Models in Animal Breeding*. Univ. of Guelph.
- Kaps M & Lamberson WR. 2004. *Biostatistics for Animal Science*. CABI.
- Mather K & Jinks JI. 1977. *Introduction to Biometrical Genetics*. Chapman & Hall.

Searle Sr. 1971. *Linear Models*. John Wiley & Sons.

Singh RK & Choudhary BD. 1977. *Biometrical Methods in Quantitative Genetic Analysis*. Kalyani.

AGB 606 CONSERVATION OF ANIMAL GENETIC RESOURCES 2+0

Objective

To educate about the concept of conservation of Animal Genetic Resources and their sustainable utilization.

Theory

UNIT I

Domestic Animal Diversity in India, its origin, history and utilization. Present status and flow of Animal Genetic Resources and its contribution to livelihood security. Methodology for genotypic characterization of livestock and poultry breeds through systematic surveys. Fodder availability; management of breed; physical, biochemical and performance traits and uniqueness of animals of a breed; social, cultural and economic aspects of their owners/communities rearing the breed.

UNIT II

Methodology for molecular genetic characterization, diversity analysis and relationship among the breeds. Concept of conservation, *In-situ* and *ex-situ* (*in-vivo* and *in-vitro*); models of conservation; prioritization of breeds for conservation. National and international strategies for conservation of Animal Genetic Resources.

UNIT III

Status, opportunities and challenges in conservation of AnGR. IPR issues pertaining to animal genetic resources/animal products or by-products. Registration of livestock breeds and protection of livestock owner's rights in India.

Suggested Readings

Lasley JF. 1987. *Genetics of Livestock Improvement*. 3rd Ed. IBH.

Nicholas FW. 1987. *Veterinary Genetics*. Claredon Press.

Ross CV. 1989. *Sheep Production and Management*. Prentice Hall.

Schmidt GM & Van Vleck LD. 1974. *Principles of Dairy Science*. WH Freeman.

Van Vleck LD, Pollak EJ & Bltenacu EAB. 1987. *Genetics for Animal Sciences*. WH Freeman.

AGB 607 CATTLE AND BUFFALO BREEDING 2+1

Objective

To educate about the concept of cattle and buffalo breeding.

Theory

UNIT I

History of dairy cattle and buffalo breeding. Breeds of cattle and buffalo and their Characterisation. Inheritance of important economic traits. Recording and handling of breeding data. Standardization of records. Computation of correction factors for the adjustment of the data. Estimation of breeding values of the cows and bulls.

UNIT II

Sire evaluation methods using single trait and multiple traits: construction of Sire indices, Sire evaluation under animal model, sire mode; and maternal grand sire model. Open nucleus breeding systems with MOET.

UNIT III

Methods of cross breeding. Breeding of type, milk quality and production efficiency. Plans for developing new breeds of dairy cattle. History of development of important breeds of dairy cattle.

UNIT IV

Considerations in the import of exotic germplasm for breeding cattle in the tropics. Appraisal of buffalo and cattle breeding programme. Role of breed associations in dairy improvement.

Practical

Performance recording – milk recording - Estimation of economic traits – Standardization of records – Index cards – Sire evaluation – Comparison of latest methods - Computation of genetic parameters – Genetic gain – Estimation of heterosis – Culling and replacement.

Suggested Readings

- Lasley JF. 1987. *Genetics of Livestock Improvement*. 3rd Ed. IBH.
Nicholas FW. 1987. *Veterinary Genetics*. Clarendon Press.
Ross CV. 1989. *Sheep Production and Management*. Prentice Hall.
Schmidt GM & Van Vleck LD. 1974. *Principles of Dairy Science*. WH Freeman.
Van Vleck LD, Pollak EJ & Bltenacu EAB. 1987. *Genetics for Animal Sciences*. WH Freeman.

AGB 608

SMALL FARM ANIMAL BREEDING (Sheep, Goat, Swine and Rabbit)

2+0

Objective

To educate about the small farm animal breeding concepts.

Theory

UNIT I

Breeds–Economic traits–Prolificacy–Breeding records and standardization.

UNIT II

Genetic parameters – Selection of males and females – Breeding systems. Development of new breeds.

UNIT III

Breeding policy – Breeding research – Conservation of breeds.

UNIT IV

Culling and replacement – EADR.

Suggested Readings

- Ross CV. 1989. *Sheep Production and Management*. Prentice Hall.
Turner HN & Young SSY. 1969. *Quantitative Genetics in Sheep Breeding*. MacMillan.
Van Vleck LD, Pollak EJ & Bltenacu EAB. 1987. *Genetics for Animal Sciences*. WH Freeman.

AGB 609

POULTRY BREEDING

2+1

Objective

To educate about the advances in poultry breeding practices.

Theory

UNIT I

Origin and history of poultry species: Chicken, turkey, duck and quail – Important qualitative traits in poultry including lethals – Economic traits of egg-type chicken and their standardization – Selection criteria – Aids to selection: Index selection and Osborne index – Restricted selection index – Economic traits of meat – type chicken and their standardization.

UNIT II

Selection criteria and selection indices – Response to selection – Genetic controls – Genotype and environment interaction – Inbreeding, and its effects on production traits in egg and meat-type chickens – Inbred lines – Strain development – Crossing : strain and line crosses – Introduction to diallel cross – Utilisation of heterosis and reciprocal effect – Reciprocal recurrent selection and recurrent selection.

UNIT III

Industrial breeding – Artificial insemination in chicken – Autosexing – Random Sample Test.

UNIT IV

Biochemical variants and immunogenetics of poultry – Use of molecular genetics in poultry breeding – Quantitative trait loci and marker-assisted selection – Conservation of poultry genetic resources

Practical

Inheritance of qualitative traits – Economic traits of egg-type and meat-type chicken – Procedures of standardization – Estimations of heritability, correlation between various production traits, inbreeding co-efficient and heterosis – Selection of sires and dams – Osborne index – Restricted selection index – Collection and evaluation of semen and insemination – Diallel cross.

Suggested Readings

Crawford RD.1990. *Poultry Breeding and Genetics*. Elsevier.

Hutt FB. 2003. *Genetics of Fowl*. Norton Greek Press.

Singh RP & KumarJ. 1994. *Biometrical Methods in Poultry Breeding*. Kalyani.

AGB 610

LABORATORY ANIMAL BREEDING

1+0

Objective

To educate about the laboratory animal breeding principles.

Theory

UNIT I

Introduction to laboratory animal genetics – Breeding colonies of mice, rats, hamsters, guinea pigs and rabbits.

UNIT II

Selection and Mating methods/systems – monogamous, polygamous and others.

UNIT III

Development of genetically controlled laboratory animals – Rules for nomenclature, inbred strains, outbred stocks, mutant stocks, recombinant inbred strains, transgenic strains, gene targeting and production of ‘gene knock-out’ animals.

UNIT IV

Genetic control and monitoring – Record keeping – Ethics of laboratory animal use.

Suggested Readings

Van Vleck LD, Pollak EJ & Bltenacu EAB. 1987. *Genetics for Animal Sciences*. WH Freeman.

Suggested Broad Topics for Masters Research

- Animal Genetic Resources characterization and evaluation using field survey and molecular markers
- Animal Genetic Resource enhancement through selection/crossbreeding/reproductive biotechnology/molecular biology
- Identification of molecular markers for economic traits
- Genetic basis for improvement in quantitative traits
- Breeding tools for Sire evaluation
- Appropriate models for evaluating animal breeding values
- Transgenesis and gene transfer
- Genetics of Disease Resistance

10.ANIMAL NUTRITION
Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
ANN 601	ANIMAL NUTRITION – ENERGY AND PROTEIN	3+0
ANN 602	ANIMAL NUTRITION – MINERALS, VITAMINS AND FEED ADDITIVES	3+1
ANN 603	FEED TECHNOLOGY	1+1
ANN 604	FEED CONSERVATION ,STORAGE AND QUALITY CONTROL	2+2
ANN 605	RUMINANT NUTRITION	2+1
ANN 606	NON-RUMINANT NUTRITION	1+1
ANN 607	NUTRITION OF COMPANION/LABORATORY, WILD AND ZOO ANIMALS	2+1
ANN 608	RESEARCH TECHNIQUES IN ANIMAL NUTRITION	1+3
ANN 609	NON CONVENTIONAL FEED STUFF AND TOXIC CONSTITUENTS/ANTIMETABOLITES IN ANIMAL FEEDSTUFF	2+1
ANN 691	MASTER’S SEMINAR	1+0
ANN 699	MASTER’S RESEARCH	20

Major Subjects	Minor Subjects
Animal Nutrition	Veterinary Bio-chemistry, Veterinary Physiology, Livestock Stock Production and Managment Animal Biotechnology Livestock Product Technology

Note: The choice of minor courses other than those listed above, may be allowed on the recommendations of advisory committee, if essentially required as per the research problem, with the concurrence of Head of the department and Dean post graduate studies.

ANIMAL NUTRITION

Course Contents

ANN 601 ANIMAL NUTRITION – ENERGY AND PROTEIN 3+0

Objective

Familiarization with fundamental concepts of energy and proteins, metabolism of carbohydrate, fat and protein and their efficiency of utilization. Requirement of carbohydrates, fat and proteins for various physiological functions.

Theory

UNIT I

Basic terminology and classification of carbohydrates, fats and proteins. Fundamental concepts of Digestion and metabolism of Carbohydrate Fat and Protein in different species of animals. Gluconeogenesis, Recent advances in glucogenic precursors on acetate utilization. NPN metabolism, urea fermentation potential and metabolizable protein. Amino acids imbalance, antagonism and toxicity.

UNIT II

Measures of feed energy. Partitioning of feed energy. Efficiency of energy and Protein utilization. Feeding standards- comparative appraisal and limitations.

UNIT III

Rumen degradable Protein (RDP), and rumen undegradable protein (UDN) and Kinetics. Energetics of protein synthesis and turn over. Quantification of microbial protein synthesis. Protein quality determination in monogastrics and utility.

UNIT IV

Energy balance, Fasting catabolism. Direct and indirect calorimetry. Determination of energy and protein requirements. Energy and protein requirement for maintenance, growth, pregnancy and lactation in ruminants, companion animals and poultry.

Suggested Readings

- Blaxter K. 1989. *Energy Metabolism in Animal and Man*. Cambridge Univ. Press.
- Bondi A. 1987. *Animal Nutrition*. Wiley InterScience.
- Crampton EW & Harris LE. 1969. *Applied Animal Nutrition*. WH Freeman.
- Maynard LA, Loosli JK, Hintz HF & Warner RG. 1987. *Animal Nutrition*. McGraw-Hill.
- McDonald P, Edwards RA & Greenhalgh JFD. 1995. *Animal Nutrition*. Longman.
- Ponds WG, Church DC, Pond KR & Schoknecht PA. 2005. *Basic Animal Nutrition and Feeding*. Wiley Dreamtech India.
- Singh UB. 1987. *Advanced Animal Nutrition for Developing Countries*. Indo-Vision.

Objective

Role, requirement, functions, deficiency and toxic effects of vitamins, essential, probably essential and toxic minerals. Understanding soil-plant-animal- human relationship for utilization of minerals. Recent trends in the use of feed additives, probiotics, prebiotic and enzymes in animal feeding.

TheoryUNIT I

Essential minerals, general role of minerals, soil-plant-animal-human relationship, requirement of minerals, factors affecting requirements. Macro elements and micro elements, their distribution, metabolism, physiological functions, deficiencies and excesses, requirements and sources. Probable essential minerals. Toxic minerals.

Definition, history, classification, chemistry, functions, deficiencies and excesses, requirements and sources of water soluble and fat-soluble vitamins.

UNIT II

Critical minerals for ruminants and non-ruminants, chelates and chelated minerals. Inter-relationship of minerals with other nutrients. Impact of minerals arising from industrial affluent on animal health and production. Critical limits of minerals in edible herbage. Bioavailability studies in minerals. Impact of minerals on reproduction. Area specific minerals.

UNIT III

Relationship of vitamins with other nutrients. Critical vitamins for ruminants and non-ruminants. Feed additives including probiotics Prebiotics, Symbiotics and feed enzymes. Research techniques in nutrition.

Practical

General principles of mineral estimation, Sampling and processing techniques, Estimation of macro- and micro-minerals. Determination of bioavailability of minerals. Formulation of mineral mixture for various species. Identification of adulterants and quality control. Atomic absorption spectrometry in mineral estimation. Preparation of diets for mineral studies. Principles of vitamin estimation. Estimation of some important vitamins (vitamin A,E,C). Formulation of vitamin mixture for various species.

Suggested Readings

- Banerjee GC. 1988. *Feeds and Principles of Animal Nutrition*. Oxford & IBH.
- Krishna G & Ranjhan SK. 1991. *Special Analytical Techniques*. Kalyani.
- McDonald P, Edwards RA & Greenhalgh JFD. 1995. *Animal Nutrition*. Longman.
- McDowell LR. 2003. *Minerals in Animal and Human Nutrition*. Reed Elsevier India.
- Peter RC. 2005. *Applied Animal Nutrition Feeds and Feeding*. Pearson Prentice Hall.
- Ponds WG, Church DC, Pond KR & Schoknecht PA. 2005. *Basic Animal Nutrition and Feeding*. Wiley Dreamtech India.

Reddy DV. 2003. *Principles of Animal Nutrition and Feed Technology*.
Oxford & IBH.

Underwood EJ & Shuttle 1999. *The Mineral Nutrition of Livestock*. 3rd Ed.
CABI.

ANN 603

FEED TECHNOLOGY

1+1

Objective

Introduction to the subject, formula feed manufacturing and different operations involved. Layout, designing, operation and management of feed mill.

Theory

UNIT I

Importance of feed technology in relation to animal productivity. The integrated biological, chemical and physical basis for evaluating the inherent nutritional quality of feed ingredients and feeds.

Familiarization of various feed mill equipments, layout and operations. Problems of feed manufacturing units and control measures. Quarantine measures.

UNIT II

Introduction to the formula feed manufacturing including principles of material handling, grinding, mixing, pelleting and other major processing operations. Crumbling, Flaking, Popping, Extrusion.

Principles of instrumentation and analysis, with emphasis on application to quality control and research in the feed industry.

UNIT III

The formulation of concentrate mixtures, premixes and rations using computer. Automated feed mill. Personal management in feed plants, laws and regulation of feed manufacturing industry. Codex alimentarius, HACCP.

Organizational charts for small, medium and large feed plants, labour standard, planning and production programme, handling of plant equipment. Merits and demerits of automated feed plant

Practical

Identification of feed ingredients and their specifications, as well as compound feed for different categories of livestock and poultry. Feed microscopy. Formulating premixes. Introduction to Pulverisers, pelletisers, complete feed blocks equipments Plant layout and design of different capacity of feed mills, problems related to feasibility, records keeping in different sections of feed mill. Experiential learning at the feed plant for preparing feed, urea molasses mineral blocks, mineral mixture.

Suggested Readings

Banerjee GC. 1988. *Feeds and Principles of Animal Nutrition*. Oxford & IBH.
Givens DI. 2000. *Forage Evaluation in ruminant Nutrition*. Great Britain
Publ.

Gohl BO. 1985. *Tropical Feeds*. FAO.

Lohan OP, Chahal SM & Kishore N. 1998. *Feed Quality Evaluation Techniques*. CCS Haryana Agricultural Univ. Press.

- McEllihner, Robert R. 1994. *Feed Manufacturing Technology*. The American Feed Industry Assoc.
- Perry TW. 2004. *Feeds and Feeding*. Prentice Hall.
- Ponds WG, Church DC & Pond KR. 1995. *Basic Animal Nutrition and Feeding*. John Wiley & Sons.
- Zaworski F. 1997. *Feed Industry Red Book*. ZMAG Publ.

ANN 604 FEED CONSERVATION, STORAGE AND QUALITY CONTROL 2+2

Objective

To acquaint with inherent nutritional quality of feed ingredients and feeds. Evaluation of feeds and fodders and feed preservation techniques. Procurement and storage of feed ingredients. Losses during storage and its control.

Theory

UNIT I

Principles of feed and fodder processing and preservation techniques, their merits and demerits. Procurement, planning and purchase procedures; traditional and modern farm level storage structures. Feed storage and godown management, estimation of storage capacity and stack plan.

UNIT II

Evaluation of processed and preserved feeds and forages. Role of moisture, temperature and relative humidity during storage of feedstuffs and their effect on biotic factors. Handling and storage of liquid feed Ingredients. Physical and chemical changes in feeds during storage; storage losses; insect pests and rodents in feed stores and their control; Role of fungi, tolerance limits and measures to check them in stored products.

UNIT III

Factors affecting the quality of feed and feedstuffs on preservation. Microbiological evaluation of processed and preserved feeds, Effect of preservation on nutritional value of feed. Properties and mode of action of pesticides and fumigants; principles of good sanitation and hygiene of godowns.

UNIT IV

Proximate composition, Limitations of various systems of analysis, Partitioning of forage fibre by Van Soest method, Quality control of fed ingredients, Specifications of feed ingredients and finished feeds, BIS standard., Pesticide and insecticide residues in feeds

Practical

Laboratory evaluation of preserved and processed feed and forages. Physical properties of feeds and feedstuffs; identification of insect-pests and fungi in stored products; techniques for detection of hidden infestation in grains; quality control and inspection of stored feed materials; moisture equilibrium determination and estimation of chemical changes including alcoholic acidity, rancidity and uric acid in feeds during storage.

Weende proximate analysis, Van Soest fibre fractionation, Enzymatic evaluation, Pro rata deduction (Feed laws), urea, FFA, peroxide value, adulterants, and heavy metal

Suggested Readings

- Givens DI. 2000. *Forage Evaluation in Ruminant Nutrition*. Great Britain Publ.
- Khare BP. 1994. *Stored Grain Pests and their Management*. Kalyani.
- Krishna G & Ranjhan SK. 1991. *Special Analytical Techniques in Nutritional Biochemistry*. Kalyani.
- Lohan OP, Chahal SM & Kishore N. 1998. *Feed Quality Evaluation Techniques*. CCS Haryana Agricultural Univ. Press.
- McEllihner Robert R. 1994. *Feed Manufacturing Technology*. The American Feed Industry Assoc.
- Ponds WG, Church DC & Pond KR. 1995. *Basic Animal Nutrition and Feeding*. John Wiley & Sons.

ANN 605

RUMINANT NUTRITION

2+1

Objective

Requirement of nutrients for different physiological functions in various ruminant species. Latest concepts of feeding the nutrients for maximising production.

Theory

UNIT I

Nutrients and their metabolism with special reference to milk, meat and wool production.

UNIT II

Feeding standards, their history, comparative appraisal and limitations. Classification of feedstuffs. Nutrient requirements for calves, heifers, dry, pregnant and lactating cows, buffaloes, sheep and goat.

UNIT III

Introduction to rumen microflora and fauna. Development of rumen. Role of milk replacers and calf starters

UNIT IV

Feed formulation of large and small ruminants for different physiological stages. Concept of complete feed. Limiting nutrients and strategic feeding of high yielding ruminants. Concept of by-pass nutrients and their impact on production, reproduction and immune status. Importance of CLA, omega fatty acids, Scope for value addition in milk, Different systems of feeding buffalo for beef production.. Feeding during natural calamities, feeding in various agro-climatic zones of India.

Practical

Design and planning of feeding experiments. Identification of feed and fodder on the basis of its composition. Artificial rumen technique, Methods for evaluation of feedstuffs - in vitro gas, in sacco digestion kinetics. Determination of nutritive value of feeds and fodders by metabolism trial in dairy cattle, determination of nutritive value of pastures by the use of range techniques, study of rumen metabolic profile. Preparation of Bypass Nutrients Identification of rumen microbes and rumen studies.

Suggested Readings

Dhority BA. 2003. *Rumen Microbiology*. Nottingham Univ. Press.
Kellems RO & Church DC. 2002. *Livestock Feeds and Feeding*. Prentice Hall.
Ranjhan SK. 2001. *Animal Nutrition in the Tropics*. Sangam Books.

ANN 606 NON-RUMINANT NUTRITION 1+1 Objective

Requirement of nutrients and feeding of various non-ruminants species for efficient quality production.

Theory

UNIT I

Nutrients, their metabolism and requirements for poultry and swine during different stages of growth and production. Limiting amino acids-lysine and methionine.

UNIT II

Feeding systems and feed additives, feed formulations for different purposes including least cost rations.

UNIT III

Quality control of poultry and swine rations for efficient egg and meat production. Nutrition in relation to disease and stress.

UNIT IV

Nutritional factors affecting quality of the products. Hind gut fermentation and its importance, Nutrient requirements of rabbits and equines, Nutritional manipulation for producing value added egg, meat / pork

Practical

Design and planning for poultry and swine feeding experiments, formulation and compounding of general and least cost rations, determination of nutritive value of poultry and swine feeds by balance experiments, evaluation of protein quality, Visit to poultry and piggery units, feed and fodder stores, Use of software in least cost feed formulations. Basic principles governing the least cost formulation software's.

Suggested Readings

Leeson S & Summers JD. 2005. *Commercial Poultry Nutrition*. International Publ. House.
Ponds WG, Church DC, Pond KR & Schoknecht PA. 2005. *Basic Animal Nutrition and Feeding*. Wiley Dreamtech India.
Rose SP. 1996. *Principles of Poultry Science*. CABI.
Stevan I, Scott ML & John DS. 2001. *Nutrition of the Chicken*. Univ. of Guelph.

ANN 607

NUTRITION OF COMPANION, LABORATORY, WILD 2+1 AND ZOO ANIMALS

Objective

Preparation, storage and evaluation of feeds and feeding standards of companion/ laboratory /wild and zoo animals

Theory

UNIT I

Feed Habbits, food Patterns, digestive structure and functions companion,

laboratory, wild and zoo animals. Natural dietary habits. Nutritional requirements of various species of animals.

UNIT II

Feeding standards and feeding habits of companion / laboratory animals. Importance of colostrum and feeding of neonates and growing animals. Feeding and care of nursing mothers. Feeding of sick and old animals. Post Surgical nutrition.

UNIT III

Ration formulation for captive animals. Artificial feeding and feeding during emergency. Nutritive characteristics of forages for wild animals. Adequacy of forage plants for wild and zoo animals. Diets used in captivity. Raising orphans. Nutritional melodies. . Nutrition of semi wild and semi domestic animals like mithun and yak under special topography

UNIT IV

Composition, presentation, sterilization, palatability, assessment and storage of companion/laboratory animal diets. companion food tables and their nutritional assessment. Mistakes and misleading information on companion food labels and labeling.

UNIT V

Nutraceuticals in companion / laboratory foods and animal foods. Nutritional deficiency diseases. Geriatric nutrition – corrective measures

Practical

Formulation and preparation of hygienic, balanced diets and feeding for companion/laboratory animals. Characteristics of ration formulation and feeding schedules wild and zoo animals. Feeding schedules for sick and orphan wild / zoo animals. Artificial and emerging feeding. General feeding habits and different feed constituents of wild and captive animals. Research methodology of companion/laboratory animals. Processing and storage of companion/laboratory diets. Visit to Zoological parks and wildlife sanctuary.

Suggested Readings

- Case LP. 1995. *Canine and Feline Nutrition*. St. Louis Publ. Church DC. 1980. *Digestive Physiology and Nutrition in Ruminants*. Oxford Press.
- Givens DI, Owel E, Aford REF & Omed HM. 2000. *Forage Evaluation in Ruminant Nutrition*. CABI.
- Petter WL & Pearson AEG. 1971. *The Laboratory Animals- Principles and Practices*. Academic Press.
- Reddy DV. 2003. *Applied Nutrition*. Oxford & IBH.
- Robbins C & Cunha T. 1994. *Wildlife Feeding and Nutrition*. Reed Elsvier.

ANN 608

RESEARCH TECHNIQUES IN ANIMAL NUTRITION

1+3

Objective

Planning and designing of experiments, use of various techniques in estimating chemical and bio-chemical constituents in feeds, fodders, blood, milk, rumen liquor, meat, wool etc.

Theory

UNIT I

Principles of animal experimentation. Specialized feed compounding. Introduction and principle of GLC, HPLC, AAS, tracer technique, flame photometer, NIR, SF6, amino acid analyzer.

UNIT II

Importance and principle of various techniques in estimating chemical and biochemical constituents and toxic principles in feeds, fodders. Importance, principles and procedures for estimating chemical and biochemical constituents in blood, milk, rumen liquor, meat, wool etc.

Practical

Cell Wall partitioning, Lignin as internal marker in feedstuffs, Mineral estimation by atomic absorption spectrophotometer, In-vitro/in-sacco determination of digestibility and digestion kinetics. Determination of energy content of feed, faeces and urine using bomb calorimeter. Methodology for quality improvement of animal feeds. Interpretation and presentation of results. Tracer techniques in Animal Nutrition. Quality evaluation of silage and hay, feed energy estimation; nitrate, urea, aflatoxin, salmonella, glycosides and sedimentation tests. Blood profile, meat quality.

Suggested Readings

Bondi AA. 1987. *Animal Nutrition*. Wiley InterScience.

Gupta PC, Khatta VK & Mandal AB. 1988. *Analytical Techniques in Animal Nutrition*. CCS HAU Press.

Pandey DN & Bajpai A. 2003. *Recent Trends in Animal Nutrition and Feed Technology for Livestock, Pets and Laboratory Animals*. International Book Distr.

Reddy DV. 2003. *Principles of Animal Nutrition and Feed Technology*. Oxford & IBH.

ANN 609

NON CONVENTIONAL FEEDSTUFFS AND TOXIC CONSTITUENTS / ANTIMETABOLITES IN ANIMAL FEEDSTUFF 2+1

Objective

To understand the importance of alternate feeds and their use in augmenting profit in livestock farm. Different toxins present in feed stuffs, their properties and detoxification techniques.

Theory

UNIT I

Present and future feed requirements and current availability for livestock and poultry. Use of non-traditional feeds – By-products of agricultural, industrial, food processing units and forest by-products. Evaluation by chemical and biological methods. Formulation of economical rations. Level of inclusion of various non conventional feeds in livestock ration

UNIT II

Classification of toxic principles in animal feedstuffs. Chemico-physical properties of various toxins. Effect of toxins on biological system and nutrients utilization in different species of livestock. Detoxification of toxin principles

by various physical, chemical and biological techniques. Insecticide and pesticide residue detection.

Practical

Estimation of various protease inhibitors; tannins; and mycotoxins in various feeds and feedstuffs. Nitrates, HCN, oxalates, insecticide and pesticide residues, saponins, Gossypol, mimosine, heavy metals..

Suggested Readings

- Banerjee GC. 1988. *Feeds and Principles of Animal Nutrition*. Oxford & IBH.
- Liner IE. 1980. *Toxic Constituents of Animal Food Stuffs*. Academic Press.
- Lohan OP, Chahal SM & Kishore N. 1998. *Feed Quality Evaluation Techniques*. CCS Haryana Agricultural Univ. Press.
- McDonald P, Edwards RA & Greenhalgh JFD. 1995. *Animal Nutrition*. Longman.
- Ponds WG, Church DC & Pond KR. 1995. *Basic Animal Nutrition and Feeding*. 4th Ed. John Wiley & Sons.
- Ranjhan SK. 2001. *Animal Nutrition in the Tropics*. Sangam Books.
- Reddy DV. 2003. *Principles of Animal Nutrition and Feed Technology*. Oxford & IBH.

Suggested Broad Topics for Masters Research

- * Utilization of non conventional feed/ fodder resources
- * Evolving / Assessing feed additives / supplements
- * Manipulation of rumen fermentation to enhance productivity
- * Feed processing for efficient utilization
- * Improving palatability, digestibility of companion food
- * Preservation and storage of feed / fodder
- * Developing functional foods though dietary manipulation
- * Neonatal growth stimulants
- * Developing sick diet / Geriatric diet to companion/ domestic/ Wild animals
- * Problem solving approach like formulating area specific mineral mixture
- * Developing residue free animal produce through dietary management
- * Addressing global issues /pollutants through feeding manipulation

11.LIVESTOCK PRODUCTION AND MANAGEMENT

Course Structure - at a Glance

CODE	COURSE TITLE	CREDITS
LPM 601	CATTLE AND BUFFALO PRODUCTION AND MANAGEMENT	2+1
LPM 602	SHEEP AND GOAT PRODUCTION AND MANAGEMENT	2+1
LPM 603	SWINE PRODUCTION AND MANAGEMENT	1+1
LPM 604	LABORATORY ANIMAL PRODUCTION AND MANAGEMENT	1+1
LPM605	SHELTER MANAGEMENT	1+1
LPM 606	PRINCIPLES OF ENVIRONMENTAL HYGIENE AND WASTE MANAGEMENT	2+0
LPM 607	CLIMATOLOGY AND ANIMAL PRODUCTION	1+0
LPM 608	POULTRY FARM AND HATCHERY MANAGEMENT	2+1
LPM 609	FARM ANIMAL BEHAVIOR	1+0
LPM 610	INTEGRATED LIVESTOCK FARMING SYSTEM	2+1
LPM 611	EQUINE PRODUCTION AND MANAGEMENT	1+1
LPM 612	WILD LIFE MANAGEMENT AND CONSERVATION	2+0
LPM 613	LIVESTOCK BUSINESS MANAGEMENT	1+1
LPM 691	MASTER'S SEMINAR	1+0
LPM 699	MASTER'S RESEARCH	20

Major Subjects	Minor Subjects
Livestock Production and Management	Animal Nutrition, Animal Genetics & Breeding, Livestock Products Technology , Veterinary and Animal Husbandry Extension Education

Note: The choice of minor courses other than those listed above, may be allowed on the recommendations of advisory committee, if essentially required as per the research problem, with the concurrence of Head of the department and Dean post graduate studies.

LIVESTOCK PRODUCTION AND MANAGEMENT

Course Contents

LPM 601 CATTLE AND BUFFALO PRODUCTION AND MANAGEMENT 2+1

Objective

To acquaint students on basic aspects of dairying in India compared with developed countries, problems and prospectus of dairying, detailed aspects of care and management of different classes of dairy cattle and buffaloes.

Theory

UNIT I

Introduction – Development of Dairy Industry in India and world - Present status and future prospects of livestock development in India

UNIT II

Important breeds of cattle and buffalo, traits of economic importance and their inter-relationships - Selection of high quality animals - Role of management in improving the reproduction efficiency in farm animals. - Housing and rearing systems.

UNIT III

Breeding Management: System of breeding Economic traits. Methods of Breeding - Prenatal and postnatal care and management of cattle and buffalo - Care of neonate and young calves - Management strategies for reducing mortality in calves, age at first calving and calving interval in cattle and buffaloes.

UNIT IV

Management of labour, Milking management, Machine milking and hand milking, Different laws governing the livestock sectors to produce quality products on par with international standards - Technique of harvesting clean and hygienic livestock products, transportation of animals, health management. Wallowing in buffaloes- Management of draught animals and summer management

UNIT V

Feed and fodder resources used for feeding of cattle and buffaloes– Scientific technique of feeding, watering – Computation of practical and economical ration, supply of green fodder around the year and enrichment of poor quality roughages.

Practical

Visits to cattle farms and critical analysis of various types of managerial practices - Study of breeding management in the farm- Analysis of practical feeding management- Disease control- Housing – milking - calf, heifer and adult management- Dairy Cattle and Buffalo judging - Project preparation for external funding and commercial farms and enterprises for dairy products – marketing strategies for milk and milk products and meat.

Suggested Readings

Arora SP. 1997. *Feeding of Dairy Cattle and Buffaloes*. Kalyani.

Dutta G. 1994. *Care and Management of Dairy Cattle and Buffaloes*. 3rd Ed. ICAR.
Thomas CK & Sastry NSR.1991 *.Dairy Bovine Production*. Kalyani.

LPM 602 SHEEP AND GOAT PRODUCTION AND MANAGEMENT 2+1

Objective

To acquaint students on status of sheep and goat farming in India, importance of record keeping, principles of housing and feeding, breeding management to improve the reproductive efficiency and detailed account on care and management of different classes of sheep and goat.

Theory

UNIT I

Introduction - Population structure and importance- Advantages and disadvantages of sheep farming under different systems of management – type of housing and equipments- Important sheep and goat breeds- Advantages and disadvantages of sheep and goat farming.

UNIT II

Breeding Management: Breeding seasons - fitness of purchase for first breeding - methods of detection of heat - Natural Service and artificial insemination - Care of the pregnant Animals - Breeding stock - Use of teaser
* Culling.

UNIT III

Feeding Management: Feeding methods - Principles to be followed in feeding and watering- feeder space, waterer space, Designing feeders and waterers. - Range management - Stocking rate and pasture improvement and utilization; management under stall fed conditions, Transportation of sheep and goat.

UNIT IV

Disease Management: Role of management in the prevention and control of diseases. Special Management: Deworming - Dipping and spraying- shearing - Avoidance of goatry odour in milk, Topping

UNIT V

Wool: Importance of wool - Fiber structure- Fleece characters - Goat fibers - Characters of mohair and pashmina, fur and Angora - Marketing of goat fibers / wool.- Planning of sheep and goat farm of various sizes - Economics of sheep and goat farming.

Practical

Visit to sheep and goat farms and critical analysis of various managerial practices under different conditions. Study of practical housing management - Analysis of practical diseases control management - Shearing management - Record keeping. - Preparation of project for commercial farming - Characterization of sheep and goats; handling of sheep and goat; daily and periodical operations for sheep and goats - Methods of identification of sheep and goat. Cost of rearing sheep and goat for mutton and wool - Housing plans for various age and categories of sheep and goat - Dipping; Vaccination of sheep and goat - Shearing of wool.

Suggested Readings

- Devendra C & Mecleroy GB. 1982. *Goat and Sheep Production in Tropics*. Longman.
- Gupta JL. 2006. *Sheep Production and Management*. BS Publ.
- ICAR. 2002. *Handbook of Animal Husbandry* 3rd Ed. ICAR.
- Kaushish 1994. *Sheep Production in the Tropics and Sub Tropics*. Scientific Publ.

LPM 603

SWINE PRODUCTION AND MANAGEMENT

1+1

Objective

To impart knowledge on various aspects of swine farming in India, principles of housing, breeding, feeding and health care of pigs, management practices at different stages of growth and economic pig production systems.

Theory

UNIT I

Introduction - Population and importance - Economic contribution of pigs - Advantages and disadvantages of swine keeping - Systems of management - Problems in pig farming.

UNIT II

Breeds of pigs - Selection of breeding stock - Breeding seasons - Age and weight at first services - Methods for detection of heat – Natural service and artificial insemination - Care of pregnant sows, piglets and growers - Care of breeding boar.

UNIT III

Housing, sanitation and hygiene, disease prevention measures - Housing and equipment –Wallowing - Sanitation and hygiene - Role of management in the prevention and the control of diseases.

UNIT IV

Feeding and management of new born, weaner and finishers, dry, pregnant and farrowing sows - Feeding principles to be followed - Methods of watering – Feeder space – Water space, etc - Marketing: Methods of marketing in swine production - Record keeping.

Practical

Visits to piggeries and critical Analysis of various types of managerial practices - Analysis of the trend and structures of pig population - Analysis of practical breeding management methods, practical disease control management - special management methods - Ageing and identification – Judging - Constraints and remedial measures in pig farming - Economics of production - Project preparation for research and commercial farms.

Suggested Readings

- Boden (e) S.1995. *Swine Practice*. WB London.
- Narayankhedkar SG. 1997. *Production and Management of Swine, Camel, Equine and Yak*. Tindall Publ.

LPM 604**LABORATORY ANIMAL PRODUCTION AND MANAGEMENT 1+1****Objective**

To educate the students become familiarize with various aspects of rabbit farming, problems and prospectus, principles of housing, breeding, feeding and health care of rabbits,rats, mice and guinea pigs, measures to reduce the mortality in young ones at different seasons .

TheoryUNIT I

Introduction - Importance of rabbit for meat and fur production, rats, mice and guinea pigs, - Common breeds and strains.

UNIT II

System of housing – Common diseases and their control measure. Management of specific pathogen free and gnotobiotic animals, concepts to related to welfare of laboratory animals

UNIT III

Breeding - Age at maturity, litter size - Weaning – Feeding of growers – Selection of replacement stock, transportation of rabbit.

UNIT IV

Transportation of Laboratory animals – marketing of meat and fur.

Practical

Handling and restraining of laboratory animals - Visits to small animal farms and critical analysis of various types of managerial practices- Analysis of the trend and structures of Laboratory animals population - Analysis of practical breeding management methods - practical disease control management and special management methods - Ageing and identification – Judging - Economics of production.

Suggested Readings

Indian Soil Institute.1993. *Rabbit Management*. IBH & Oxford.

Reddy DV. 2007. *Applied Nutrition: (Livestock, Poultry, Human, Pet, Rabbit and Laboratory Animal Nutrition)*. IBH & Oxford.

Ronald N & Penman S. 1991. *A Manual for Small Scale Rabbit Production*. South Asia Publ.

LPM 605**SHELTER MANAGEMENT****1+1****Objective**

To familiarize students with type of houses suited for different livestock under varying climatic conditions.

TheoryUNIT I

General principles in planning animal houses- farmstead and animal houses - Selection of site and planning; layouts for livestock farm of different sizes in different climatic zones in India - Farm structures - General principles of construction of enclosures, floor and road.

UNIT II

Housing requirements of different classes of Livestock - Preparation of layouts, plans, arrangement of alleys- Fitting and facilities in the houses for

horses, dairy cattle, calves, bulls, work cattle, dogs, pigs, sheep, goats, and poultry.

UNIT III

Improvement of existing buildings; water supply; feed and fodder delivery systems - Economics of Livestock housing.

UNIT IV

Housing - Disease control measures and sanitation of all classes of livestock

Practical

Score card for animal houses - Time and motion study in Animal houses - Preparation of plans for Animal houses for horses, cattle, sheep, pigs, goats, and other livestock - Dogs and other pet animals - Economics of livestock housing - Preparation of plan for animal houses of different sizes and climatic zones of India.

Suggested Readings

Sastry NSR & Thomas CK. 2006. *Livestock Production and Management*. Kalyani.

Thomas CK & Sastry NSR 1991. *Dairy Bovine Production*. Kalyani.

Wathes CM & Charles DR. 1994. *Livestock Housing*. CABI.

LPM 606

PRINCIPLES OF ENVIRONMENTAL HYGIENE AND WASTE MANAGEMENT

2+0

Objective

To familiarize students on principles of air and water hygiene with reference to impurities and inclusions of water, collection and disposal of waste from the animal house, modern techniques in manure disposal and biosecurity measures to be adapted for hygienic production of livestock products.

Theory

UNIT I

Animal air hygiene: Definition - Composition of air - Air pollution - Factors affecting outdoor and indoor pollution - Assessment of these factors on animal health and production - Methods to control these factors.

UNIT II

Water Hygiene: Importance of water - Impurities and inclusions - Sterilization - Examination of water and water supplies - Collection of samples- Topographical physical, chemical, bacteriological and microscopic examination of water - Hygienic requirements and standards for drinking water
Quantity of water required by domestic animals - Methods of watering.

UNIT III

Manure - Quantity of manure voided by domestic animals - Animal excreta a factor in spread of disease - Hygienic and economic disposal of farm waste - Modern techniques used in automation / semi-automation in disposal of farm waste.

UNIT IV

Environmental protection act, Air (Prevention and control of pollution) act and water (Prevention and control of pollution) act - Biosecurity measures to be adapted for efficient and healthy production

UNIT V

Effect of environmental pollution on livestock and its products directly and indirectly - Controlling environmental pollution - Different factors affecting the quality of livestock and its products meant for human consumption

Suggested Readings

Baba MD. 2007. *Environmental Changes and Natural Disasters*. New India Publ.

Overcash MR. 1983. *Livestock Waste Management*. CRC Press.

Thapliyal DC & Misra DS. 1996. *Fundamentals of Animal Hygiene and Epidemiology*. International Book Distr. Co.

LPM 607

CLIMATOLOGY AND ANIMAL PRODUCTION

1+0

Objective

To familiarize students on climate, weather, various climatic factors and their role in production and health of animals in both temperate and tropics, micro and macroclimatic conditions of animal house and assessing the heat tolerance of bovines.

Theory

UNIT I

Definition of climate -Classification of climatic regions - Climatic factors-Assessment of climate - Study of climatic factors in relation to animal production.

UNIT II

Light, natural and artificial light-mechanism of light action-photo period and light responses – Applications - Importance of light in production of animals and birds.

UNIT III

Introduction of breeds into different climatic regions - Agro meteorology and weather forecasting for Animal Husbandry activities - Micro climate modification in animal houses.

UNIT IV

Estimation of microclimatic conditions in Animal house - Measurement of Temperature, Relative humidity, Air Velocity and Mean temperature of the surrounding, measurement of intensity of light in animal houses - Construction of climographs and hythergraphs -Estimation of cooling power of atmosphere-heat tolerance test in bovines.

Suggested Readings

Lal DS. 1998. *Climatology*. Sharda Pustak Bhavan, Allahabad.

McDowell RE. 1972. *Improvement of Livestock Production in Warm Climates*. WH Freeman.

Siddhartha K & Roger B. 1996. *Atmosphere, Weather and Climate*. ELBS.

LPM 608

POULTRY FARM AND HATCHERY MANAGEMENT

2+1

Objective

To acquaint students on basic aspects of housing, feeding, breeding and health care of poultry and comparing the performance under cage and floor system of

management of poultry, biosecurity measures to be followed to reduce mortality and efficient hatchery management to produce healthy young ones.

Theory

UNIT I

Poultry housing systems Cage Vs floor system, litter management and lights for poultry, rearing turkey, duck and quails.

UNIT II

Management of chicks, growing, laying and breeding flocks, broiler production, selection and culling of laying flocks.

UNIT III

Procuring, care and pre-incubation storage of hatching eggs - Method of incubation, sanitation disinfection and management of hatchery.

UNIT IV

Embryonic development and factors effecting fertility and hatchability of eggs.

UNIT V

Chick sexing, packing and hatchery business - Transporting management of farm and hatchery waste.

Practical

Poultry Farm management - Brooding of chicks; selection of laying flocks - Disease preventive measures - Selection and care of hatching eggs; incubator operation, fumigation and candling setting and hatching, packaging of chicks - Waste management - Marketing of products.

Suggested Readings

Ensminger ME. 1992. *Poultry Science*. International Book Distr. Co.

Hued LM. 2003. *Modern Poultry Farming*. Greenworld.

Powell-Owen W. 2008. *Poultry Farming and Keeping*. Daya Books.

Prashad J. 2005. *Poultry Production and Management*. Kalyani.

Singh RA. 1996. *Poultry Production*. 3rd Ed. Kalyani.

LPM 609

FARM ANIMAL BEHAVIOR

1+0

Objective

To make acquainted students on principles of farm animal behaviour with regard to environmental influence, group formation, social behaviour and behavioural adaptations under domestication.

Theory

UNIT I

Introduction to Animal behaviour - Importance of animal behaviour studies - Patterns of behaviour - Daily and seasonal cycles of behaviour - Physiological basis of behaviour.

UNIT II

Environmental modification of behaviour - Developmental changes in behaviour - Genetic differences in behaviour - Behavioural disorders.

UNIT III

Group formation - Social relationship, process of socialisation locality and behaviour - Practical application - Behavioural character for managemental

practices - Favourable and unfavourable behaviour for domestication - Behavioural adaptations under domestication.

UNIT IV

Physical environment and behaviour - Common vices and their remedial measures - Analysis of behaviour in relation to location - Analysis of behaviour in relation to climatic environment - Analysis of social behaviour.

Suggested Readings

Arora MP. 1995. *Animal Behaviour*. WB London.

Bouenger EG. 1994. *Animal Behaviour*. WB London.

Fraser AF & Broom DM. 1997. *Farm Animal Behaviour and Welfare*. CABI.

Fraser AF & Broom DM. 1999. *Farm Animal Behaviour and Welfare*.

Kumar V. 1996. *Animal Behaviour*. WB London.

LPM 610 INTEGRATED LIVESTOCK FARMING SYSTEM 2+1

Objective

To familiarize on various aspects viz., scope and limitations of integrated livestock farming system, recent approach and economic feasibility of different integration models for sustainable production

Theory

UNIT I

Scope and limitation of integrated farming systems - Sustainability of integrated Livestock Farming Systems and their economic importance.

UNIT II

Integration of fish, arable farming and different livestock enterprises vis-à-vis gobar gas plant, FYM, solar and wind energy utilization, cattle, buffalo sheep, goat, pig, poultry, rabbit, silk worm, bee keeping etc.

UNIT III

New approach for changing farming systems in present energy crises.

UNIT IV

Project formulation and evaluation of various livestock enterprises.

Practical

Various livestock farming units and their economic analysis - Evaluation of different farming systems and their economic importance - Preparing feasibility report for various farming projects.

Suggested Readings

Mukherjee TK. 1992. *Integrated Livestock Fish Production Systems*.

Raman KV & Balaguru T. (Eds.). 1992. *Farming Systems Research in India: Strategies for Implementation*. NAARM.

Renard C. (Ed.). 1997. *Crop Residues in Sustainable Mixed Crop/Livestock Farming Systems*. CABI.

Speirs M. & Opsen O. 1992. *Indigenous Integrated Farming System in the Sahel*. World Bank.

LPM 611

EQUINE PRODUCTION AND MANAGEMENT

1+1

Objective

To educate the students become familiarize with principles of housing, breeding, feeding and health care of different classes of horse, stable routines and measures to reduce the mortality in young ones at different seasons .

Theory

UNIT I

Equine population in India - Breeds of native and exotic horses - Types and classes of light and work horses

UNIT II

Housing and routine management practices –Hygiene and maintenance of stable. Color and markings, Dentition and ageing selecting and judging horses- unsoundness and stable vices

UNIT III

Feeding and breeding of horses donkey and Mules, foaling, care of foal

UNIT IV

Foot care and shoeing care, Stud farms - Race clubs - Race horses and their care - Horse behaviour and training - Exercising - Basic Horsemanship

UNIT V

Health management & diseases control. Control of internal and external parasites of horse- Colic and its prevention

UNIT VI

Mode of transport - Facilities requirement - Cleaning, disinfection and preparation of vehicles Transport stress - Management during transport - Regulatory acts of states and centre in animal disease control and welfare. Precautions and requirements before, during and after transport - Laws governing the import and export of livestock and its products- - Horse passport and trading

Practical

Control of horse for examination, passing of stomach tube, dentition and ageing, saddling, exercising of horse, hoof care.

Suggested Readings

Blancchard TL et al. 2002. *Manual of Equine Reproduction*. Mosby Publ.

Frape D. 1986. *Equine Nutrition and Feeding*. Blackwell Publ.

Kacker RN & Panwar BS. 1996. *Text Book of Equine Husbandry*. Vikas Publ.

Mills DS & Nankervis KJ. 1998. *Equine Behaviour: Principles and Practice*. Blackwell Publ.

Pilliner S. 1994. *Care of the competition Horse*. BT Batsford.

Rose RJ & Hodgson DR. 2000. *Manual of Equine Practice*. WB Saunders.

LPM 612

WILD LIFE MANAGEMENT AND CONSERVATION

2+0

Objective

To acquaint students with the principles and concepts of wild life sanctuaries and national parks, classification of wild animals, role of authorities in conservation and management of wild animals in captivity.

Theory

UNIT I

Zoo and captive wild animals - Principles and concepts – Ecology of wild life sanctuaries and National parks- wild life legislation in India - Status of forest in India - Biological and ecological basis of management of wild life.

UNIT II

Voluntary organization on wild life - Rules and regulations of zoo authority of India -Wild life protection act - Zoological classification of wild animals - Funding agencies for wild life research and preparation of project. - Conservation of wild animals.

UNIT III

Wild life health control - Reproduction in zoos - Population analysis - Population manipulation - Habit analysis and design - The resources and its management - Distribution of important Indian animals - Zoo animals and birds - Breeding characteristics – Movements - Cover requirements - Food - Population density – Mortality - Nesting losses caused by predators, predator and prey relationship - Human interference - Refuge rehabilitation

UNIT IV

Restraints - Maps - Survey and plans of management systems - Principles, protective measures - Development and conservation of water supply- puberty \endash Breeding seasons - pregnancy - Parturition - Lactation postnatal survival of the young - Social factors among various species - Miscellaneous management procedures.

Suggested Readings

Berwick SH & Saharia VB. (Eds.). 1995. *The Development of International Principles and Practices of Wild Life Research and Management*. Deford Univ. Press.

Bobbins CT. 1983. *Wild Life Feeding and Nutrition*. Daya Publ. House.

Giles RH. 1978. *Wild Life Management*. Wild Life Society.

Giles RH. 1984. *Wild Life Management Techniques*. 3rd Ed. Wild Life Society.

Jadhav NV, Baig MI & Devangare AA. 2004. *Handbook of Wild Animals and Livestock Management*.

WWF. 1994. *Wild Life (Protection) Act 1972 (as Amended up to 1991)*. Natraj Publ.

LPM 613

LIVESTOCK BUSINESS MANAGEMENT

1+1

Objective

To acquaint students with knowledge in principles, planning, technical approach and preparing financial statement in Livestock Business Management and preparing projects for financing.

Theory

UNIT I

Management principles - Planning - Techniques, strategic planning, organization structure, co-ordination and controlling techniques - Approaches to management.

UNIT II

SWOT analysis, financial accounting - Accounting records - Balance sheet, fund flow statement - Cost and analysis for managerial decisions - Budgeting and control .

UNIT III

Tools of financial analysis, working capital financing - Long term financial management - Investment analysis - Capital markets - Corporate risk management - Venture capital.

UNIT IV

Marketing - Objectives, strategies - Selecting and managing marketing channels - Pricing strategies - Sales promotion - Legislation relating licensing - Company law.

Practical

Preparation of financial statements, depreciation accounting methods, trend and variance analysis, cost-volume profit analysis - Financial planning and forecasting - Estimation of working capital requirement - Break even analysis - Visit to livestock business firms and banks - Preparing projects for financing.

Suggested Readings

Koontz H & O'Donnell C. 1999. *Essentials of Management*. Tata McGraw Hill.

Kotler P. 2000. *Marketing Management – Analysis, Planning and Control*. Prentice Hall of India.

Maheswari SN. 1998. *Management Accounting*. Tata McGraw Hill.

Massie JL. 1995. *Essential of Management*. Prentice Hall of India.

Srinivasan NP. 1998. *Management Accounting*. Sterling Publications.

Suggested Broad Topics for Master's Research

Dairy cattle and buffalo Production

- * Pre and postpartum management of dairy animals
- * Reducing age at first calving
- * Reducing calf mortality
- * Reducing calving intervals
- * Increasing reproductive efficiency
- * Farming system research / extension approach
- * System approach to livestock development
- * Housing management of animals in semi arid region

Poultry Production

- * Poultry housing system
- * Stocking density in poultry
- * Environmental effects on poultry
- * Feeding management of poultry
- * Methods of processing poultry manure
- * System of approach for poultry development

Small ruminant production

- * Sheep and goat housing system
- * Impact study on scientific management of sheep and goat
- * Environmental effects on sheep and goat
- * Feeding management of sheep and goat

Rabbit production

- & Rabbit housing system
- & Feeding management of rabbit
- & Productive and reproductive performance of rabbit under tropical climate

Swine production

- * Swine housing system
- * Feeding management of swine
- * Productive and reproductive performance of pigs under tropical climate

12.LIVESTOCK PRODUCTS TECHNOLOGY

Course Structure - at a Glance

CODE	COURSE TITLE	CREDITS
LPT 601	FRESH MEAT TECHNOLOGY	1+1
LPT 602	MEAT PROCESSING, PACKAGING, QUALITY CONTROL AND MARKETING	2+1
LPT 603	POULTRY AND FISH PRODUCTS TECHNOLOGY	2+1
LPT 604	EGG AND EGG PRODUCTS TECHNOLOGY	1+1
LPT 605	ABATTOIR AND POULTRY PROCESSING PLANT PRACTICES	1+1
LPT 606	SLAUGHTER HOUSE BYPRODUCTS TECHNOLOGY	2+1
LPT 607	PROCESSING AND MARKETING OF WOOL	2+1
LPT 608*	MARKET MILK PROCESSING AND DAIRY PLANT PRACTICES	2+1
LPT 609	QUALITY CONTROL OF MILK AND MILK PRODUCTS	1+1
LPT 610	TECHNOLOGY OF MILK PRODUCTS	2+1
LPT 611	BIOTECHNOLOGY OF FOODS OF ANIMAL ORIGIN	1+1
LPT 612*	IN-PLANT TRAINING (NON CREDIT)	0+2
LPT 691	MASTER'S SEMINAR	1+0
LPT 699	MASTER'S RESEARCH	20

Major Subjects	Minor Subjects
Livestock Products and Technology	Veterinary Biochemistry, Veterinary Microbiology, Veterinary Public Health, Livestock Production and Management

Note: The choice of minor courses other than those listed above, may be allowed on the recommendations of advisory committee, if essentially required as per the research problem, with the concurrence of Head of the department and Dean post graduate studies.

LIVESTOCK PRODUCTS TECHNOLOGY

Course Contents

LPT 601 **FRESH MEAT TECHNOLOGY** **1+1**

Objective

To impart knowledge about history, current status of meat industry, muscle composition, functions and sensory quality of meat. To educate on factors influencing quality of meat and nutritive value.

Theory

UNIT I

History and development of meat science and meat industry, current trends and prospects of meat industry-Structure and chemistry of animal tissues, muscle functions and postmortem changes- Rigor mortis – Effect of transport on meat quality – its veterinary and clinical importance – PSE and DFD in meat quality – Conversion of muscle to meat.

UNIT II

Composition, nutritional content and general quality characterization and evaluation of meat and its products- meat microbiology –Factors affecting quality of meat – Essential nutrients in meat and poultry meat – Tenderization. Chemical residues in meat meat and their effects on the health of the consumer.

Practical

Microbiological sampling and evaluation of meat. Evaluation of physico-chemical and sensory properties of meat and meat products. Estimation of pH – Colour - Water holding capacity – ERV – Tyrosine value – Thiobarbituric acid number – Estimation of texture profile of meat – Estimation of glycogen, R-value, myoglobin, proximate analysis of meat and meat products including poultry products – Estimation of drip loss - Determination of Sarcomere length, fibre diameter and myofibrillar fragmentation index. Retail and wholesale cuts.

Suggested Readings

- Gracey JF. 1999. *Thornton's Meat hygiene*. 10th Ed. WB Saunders.
Kerry J, Kerry J & Ledward D. 2005. *Meat Processing-Improving Quality*. Woodhead Publishing Ltd., UK.
Pearson AM & Dutson TR. 1999. *Advances in Meat Research*. Vol. IX. *Quality Attributes and their Measurement in Meat, Poultry and Fish Products*. Aspen Publishers, Inc, Maryland, USA.
Swatland H & Compbell T. 2004. *Meat Cuts and Muscle Foods*. Nottingham Univ. Press.

LPT 602 **MEAT PROCESSING, PACKAGING, QUALITY** **2+1**
CONTROL AND MARKETING

Objective

To impart knowledge on preservations, methods, product development, quality control and packaging practices in meat.

Theory

UNIT I

Factors affecting fresh meat quality, ageing, basic principles of preservation, chilling, freezing, thermal processing, dehydration, irradiation and use of chemicals and antibiotics; meat curing and smoking.

UNIT II

Comminuted meat; preparation of various kinds of fresh and cooked meat products-Canning – Heat processing – Sausages – Ham, Bacon, Tandoori-Barbecuing of Poultry.Senses of taste and olfaction- factors influencing sensory measurements, physical and chemical properties related to sensory evaluation, types of sensory panels, discriminate and descriptive testing.

UNIT III

Meat adulteration and substitution – Different techniques for meat speciation – Agar gel immuno diffusion techniques – Démonstration of CIE, IEF, ELISA, PCR

UNIT IV

Principles of packaging- Product characteristics affecting packaging requirements; packaging material and their characteristics - different methods of packaging meat – Vacuum packaging – MAP – Retort pouch processing.

UNIT V

Marketing of meat, setting up of a meat retailing unit and other meat merchandising practices. MFPO, BIS Standards for meat products.National and international specifications and standards.

Practical

Proximate composition of meat, tyrosine value, nitrite content, TBARS value, peroxide value, Formulation of different meat products, emulsion stability, shear force value, cooking determinants, subjective and objective method of sensory evaluations.

Suggested Readings

- Kerry J, Kerry J & Ledward D. 2005. *Meat Processing-Improving Quality*. Woodhead Publishing Ltd., UK.
- Pearson AM & Dutson TR. 1999. *Advances in Meat Research*. Vol. IX. *Quality Attributes and their Measurement in Meat, Poultry and Fish Products*. Aspen Publishers, Inc, Maryland, USA.
- Swatland H & Compbell T. 2004. *Meat Cuts and Muscle Foods*. Nottingham Univ. Press.

LPT 603

POULTRY AND FISH PRODUCTS TECHNOLOGY

2+1

Objective

To impart knowledge on structure, functional quality, microbiology, processing and preservation of poultry meat, eggs and fish.

Theory

UNIT I

History and development of poultry meat and egg processing industry. Different species of poultry and their production potentials- commonly occurring anti nutrients, and antibiotics in poultry feed ingredients and its

effect on egg and meat nutrition - Quality identification, quality maintenance, chemical, nutritional and microbiological quality of poultry meat. Preservation and packing techniques of shelled and liquid eggs. Quality identification of shell eggs and factors influencing the quality

UNIT II

Pre-slaughter care, transportation, resting, fasting, ante-mortem examination, methods of slaughter and slaughtering procedure-postmortem inspection-reasons for condemnation of carcass-yield and grading of dressed chicken, cut-up parts and de boned meat.

UNIT III

Structure, nutritive value, compositional chemistry, microbiology and functional properties of eggs. Low cholesterol eggs, GMP, HACCP procedures for food safety – Codex regulation for food products safety – WTO/GOI regulations for import and export of poultry products. National and international regulations, standards, quality control and marketing of fish and fish products, utilization of fish processing waste.

UNIT IV

Fishery resources, marine and fresh water fishes, transportation, processing, preservation, grading, standards. Quality control, labeling and marketing of fish and fish products, utilization of fish processing waste.

UNIT V

Post processing value added meat for export- Integration, poultry and fish processing and marketing-Storage, packaging and chilling, freezing, dehydration, canning, irradiation, curing, smoking, barbecuing, cooking and preparation of further processed poultry and fish products.

Practical

Organization, sanitation and maintenance of poultry processing plants. Slaughtering, ante-mortem and postmortem inspection, meat cutting, grading, production of ready to eat, smoked and cured poultry meat. Comminuted and other poultry based convenient items. Visit to poultry processing plant/egg processing plant. Postmortem inspection, carcass yield and grading. Meat bone ratio, quality maintenance, tenderization water holding capacity. TBA values and preparation of further processed and freeze dried poultry products. Whole egg powder, shell meal processing plant waste meal-HACCP-egg powder processing plant. Grading of shelled eggs, liquid eggs, egg powder foaming property, pasteurization of liquid egg, testing microbial load in different forms of egg, visit of egg powder plant/egg processing plant poultry and fish products and its Proximate analysis, microbiological and sensory evaluation and poultry meat and fish.

Suggested Readings

Mead GC. 1989. *Processing of Poultry*. Elsevier.

Mountney GJ. *Poultry Products Technology*. 2nd Ed. AVI Publ.

Pearson AM & Gillett TA. 1996. *Processed Meats*. 3rd Ed. Chapman & Hall.

Stadelman W & Cotterill OJ. 2002. *Eggs Science and Technology*. 4th Ed.

CBS.

Suzuki T. 1981. *Fish and Krill: Protein Processing Technology*. Applied Science Publ.

LPT 604

EGG AND EGG PRODUCTS TECHNOLOGY

1+1

Objective

To impart knowledge about composition and marketing of eggs and nutritive value of eggs, preservation methods –quality maintenance, functional and value added egg product development, packaging and standards

Theory

UNIT I

Preservation and maintenance of quality of eggs- spoilage of egg and its prevention.-Preparation of fast foods.

UNIT II

Egg breaking plant lay out and organization- freezing- pasteurization-desugarisation-dehydration – quality estimation.

UNIT III

Principles involved in preparation of egg powder and other egg products- Development of convenient egg based products- packaging of egg and egg products.

UNIT IV

Specifications, standards and marketing of egg and egg products-Quality control of egg products.

Practical

Evaluation of physical, chemical, functional and microbial quality of egg and egg products. Preservation of eggs- Preparation of dehydrated and convenient egg products- Visit to egg processing plant.

Suggested Readings

Romanoff AL & Romanoff AJ. 1949. *Avian Egg*. John Wiley & Sons.
Stadelman WL & Cotterill OJ. 2002. *Egg Science and Technology*. 4th Ed.
CBS.

LPT 605 ABATTOIR AND POULTRY PROCESSING PLANT PRACTICES 1+1

Objective

Teaching about abattoir design, sanitation and basic slaughterhouse practices, effluent treatment and proper disposal of wastes.

Theory

UNIT I

Layout, designing – operation and maintenance of slaughter houses and processing plants-disposal of slaughter house effluents and different designs of effluent treatment plants - equipments, organization and Slaughter house, maintenance, record keeping and operation-sanitation of slaughterhouse-Sanitary practices in meat plant and its benefits; quality control.

UNIT II

Pre-slaughter judging, inspection, grading, pre-slaughter care, slaughter of meat animals; Humane slaughter – Principles and methods of stunning – Ritual slaughter of food animals and poultry – Machineries for slaughter and dressing- processing of different kinds of meat animals- Ante-mortem inspection and Post-mortem examination of animals. Disposal and

condemnation of unfit materials.

UNIT III

Carcass quality appraisal, judgement and their grading, meat cutting, measuring yields. Application of HACCP, GMP, ISO 9000, ISO 14000, ISO 22000, BIS Standards and any recent standards for meat and processing industries

Practical

Visit to slaughterhouse– Plan and outlay of modern abattoir- Procedure for slaughter of food animals and poultry - Ante- mortem and postmortem inspection, slaughtering, grading and meat cutting, carcass yield, meat bone ratio measurement of effluent characteristics: pH, BOD, COD, suspended solids etc.

Suggested Readings

Gerrard F. 1977. *Meat Technology*. Northwood.

Gracey JF. 1999. *Thornton's Meat hygiene*. 10th Ed. WB Saunders.

LPT 606 SLAUGHTER HOUSE BYPRODUCTS TECHNOLOGY 2+1

Objective

To Impart knowledge on animal by-products, processing and industrial utilization.

Theory

UNIT I

Slaughterhouse byproducts industry in India and abroad – Importance of utilizing slaughterhouse offals – Rendering- Planning a by-product plant - Utilization of blood, bones, hooves, glands, intestines, feathers, glandular by-products and other minor by-products for industrial exploitation.

UNIT II

Meat fat characteristics - Preservation and Processing of ruminal contents – Ensiling of ruminal contents – Value products preparation from slaughterhouse by-products. processing of animal byproducts for pet foods.

UNIT III

Flaying - Classification and factors affecting quality of hides and skin-Physical and chemical characteristics of hide and skin- Processing of hide and skin for manufacture of leather- Preparation and quality control of gelatin and glue. Microscopic, physical and chemical characteristics of leather; testing and marketing of leather- Preservation and packaging practices of various kinds of hides and skin.

UNIT IV

Designing of animal byproduct plant. Collection and scope for further utilization of slaughter house byproducts. Waste treatment and pollution control- Environmental Audits-Regulations on pollution control.

Practical

Identification of quality defects in leather- preparation of sausage casing-blood meal, feather meal and meat meal. Demonstration of carcass meal – Meat meal – Bone meal - Preparation of animal casings – Grading of casings and wool – Preparation of slime meal – Collection and preservation of

UNIT III

Layout Designing and organization of dairy plant, Milk procurement, handling and transportation. Chilling, centrifugation, separation, clarification, bacto-fugation and homogenization. Thermal processing- pasteurization, UHT processing, sterilization, bacto-therm and packaging, Storage and distribution of processed milk. Fortified, reconstituted and mild floured milks.

UNIT IV

Membrane processing and related techniques; application of ultrafiltration, reverse osmosis; nanofiltration and microfiltration in the dairy industry.

UNIT V

Current trends in cleaning and sanitization of dairy equipment, biological detergents, ultrasonic techniques in cleaning; biodegents. Disposal of dairy effluents.

Practical

Platform tests. Determination of fat, SNF, TS, protein, lactose and ash contents of milk. Standardization, pasteurization and sterilization. HCT profile of milk systems. Judging of different types of milks. Layout plan of market milk plant.

Suggested Readings

Walstra P, Wouters JTM & Geurts TJ. 2006. *Dairy Science and Technology*. 2nd Ed. Taylor & Francis.

Web BH, Johnson AH & Alford JA. 1987. *Fundamental of Dairy Chemistry*. 3rd Ed. Westport AVI Publ.

LPT 609 QUALITY CONTROL OF MILK AND MILK PRODUCTS 1+1

Objective

To impart knowledge about quality control, TQM, HACCP, SPS, CAC and legal standards.

Theory

UNIT I

Importance of quality control in dairy industry. PFA Act, BIS standards, AgMark standards and ISO standards of milk products.

UNIT II

Total quality management in processing of milk products – HACCP and SPS.

UNIT III

Types of microorganisms associated with milk and milk products-Milk borne diseases.

UNIT IV

Physico-chemical and microbial changes during procurement, processing and storage of milk and milk products.

UNIT V

Fundamental rules for sensory evaluation, Hedonic scale, score cards and their use for grading of milk and milk products.

Practical

Determination of pH and acidity, electrical conductivity, viscosity, phosphatase test, MBRT, Resazurin test, DMC, SPC. Analysis of milk and milk products in reference to BIS/PFA standards. Grading of milk and milk products.

Suggested Readings

Jennes R & Patton S. 1969. *Principles of Dairy Chemistry*. Wiley Eastern.
Yadav JS, Grover S & Batish VK. 1993. *Comprehensive Dairy Microbiology*. Metropolitan Publ.

LPT 610

TECHNOLOGY OF MILK PRODUCTS

2+1

Objective

To impart knowledge about techniques for preparation of different milk products.

Theory

UNIT I

Drying of milk and milk products; freeze dehydration, water activity; sorption behaviour of foods- dried ice cream mix – cream and butter powder.

UNIT II

Hurdle technology and its application in development of dairy products.

UNIT III

Manufacture of milk products; butter, evaporated milk, condensed milk, milk powders, ice cream and other frozen desserts. Manufacture of yoghurt-acidophilus milk-bulgaricus milk- kumiss-kefir. Manufacture of cheddar-mozzarella- cottage and processed cheese. Manufacturing of indigenous milk products- paneer- channa- khoa- ghee- dahi and shrikhand.

UNIT IV

Manufacturing of casein - caseinate- co-precipitates- Whey protein concentrate (WPC) - lactose- dairy whiteners; functional properties of whey proteins- casein- co-precipitates- Ultra Filtration retentate and their modifications.

UNIT V

Evaluation of functional properties. Packing, storage and marketing of milk products. Defects in milk products, their preventions and remedies.

Practical

Preparation of butter- paneer- channa- ghee- ice cream- cheese-cheddar-Mozzarella and cottage cheese- khoa- dahi- yoghurt- casein- caseinate-coprecipitate- determination of degree of browning chemical/physical methods; measurement of different functional properties of different milk products.

Suggested Readings

Aneja RP, Mathur BN, Banerjee AK & Chandan RC. 2002. *Technology of Indian Milk Products*. Dairy India.
Spreer E. 1993. *Milk and Dairy Products*. Marcel Dekker.
Walstra P, Wouters JTM & Geurts TJ. 2006. *Dairy Science and Technology*. 2nd Ed. Taylor & Francis.

LPT 611 BIOTECHNOLOGY OF FOODS OF ANIMAL ORIGIN 1+1

Objective

To impart knowledge about new techniques of biotechnology for improving food value.

Theory

Role of Biotechnology in productivity of livestock, Meat Speciation and quality control. Use of Biotechnology in production of food additive. Use of biotechnological tools for the processing and preservation and foods of animal origin, use of biotechnology improved enzymes in food processing industry, consumer concerns about risks and values, biotechnology and food safety. Future of food biotechnology in India.

Practical

Introduction of basic biotechnological techniques such as western blotting, enzyme isolation and identification, DNA extraction, amplification, different types of PCR, Acquaintance with RT-PCR, Multiplex PCR, gene identification and characterization.

Suggested Readings

Selected articles from journals.

LPT 612 IN-PLANT TRAINING 0+2
(Non Credit: Satisfactory/Unsatisfactory)

Objective

To impart industrial exposure to post graduate students in meat, milk, poultry and fish industry.

Practical

APT students will undergo in-plant training in any one of the specialized area of Animal Products Technology for a period of three weeks in an institute in private/public sector industry. After completion of the training, the student will submit a training report. Evaluation will be based on viva-voce examination and a report submitted by student-Preparation of Project report.

Suggested Readings

Selected articles from journals.

Suggested Broad Topics for Master's Research

- TM Development of shelf stable meat products
- TM Development of intermediate moisture meat products
- TM Application of active packaging for improving shelf life
- TM Development of low sodium meat products
- TM Development of low fat meat products
- TM Enrichment of meat with fiber
- TM Enrichment of meat with calcium
- TM Utilization of edible byproducts
- TM Utilization inedible byproducts
- TM Prevention of oxidative rancidity in meat products
- TM Development in processing of poultry meat.
- TM Recent advances in processing of egg and egg products.
- TM Recent advances in preservation and quality control of egg and egg products
- TM

- TM Development in packaging, regulations and standards of poultry meat.
- TM Development in preservation and quality control of poultry meat.
- TM Development of functional casinates for food industry
- TM Development of phytoformula
- TM Development of geriatric biofoods
- TM Development of hydrolysed lactose milk drinks to lactose intolerants
- TM Membrane utilization in indigenous dairy products

13. VETERINARY GYNAECOLOGY & OBSTETRICS
Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
VGO 601	GENERAL GYNAECOLOGY	3+1
VGO 602	FEMALE INFERTILITY	3+1
VGO 603	VETERINARY OBSTETRICS	2+2
VGO 604	ANDROLOGY & MALE INFERTILITY	3+1
VGO 605	SEMEN PRESERVATION AND ARTIFICIAL INSEMINATION	2+1
VGO 606	REPRODUCTIVE BIOTECHNOLOGY	2+1
VGO 607	CLINICAL PRACTICE I	0+3
VGO 608	CLINICAL PRACTICE II	0+3
VGO 691	MASTER'S SEMINAR	1+0
VGO 699	MASTER'S RESEARCH	20

Major Subject	Minor Subjects*
Veterinary Gynaecology and Obstetrics	Veterinary Surgery & Radiology, Veterinary Physiology, Veterinary Biochemistry, Veterinary Medicine, Animal Biotechnology, Veterinary Pharmacology & Toxicology, Animal Nutrition

*The choice of minor courses other than those listed above, may be allowed on the recommendations of advisory committee, if essentially required as per the research problem, with the concurrence of Head of the department and Dean post graduate studies.

VETERINARY GYNAECOLOGY & OBSTETRICS

Course Contents

VGO 601

GENERAL GYNAECOLOGY

3+1

Objective

To understand hormonal regulation of female reproduction and therapeutic management of infertility.

Theory

UNIT I

Puberty and sexual maturity, role of hypothalamic-pituitary-gonadal axis in attainment of puberty and sexual maturity, onset of postpartum ovarian activity, Endocrine regulation of estrous cycle.

UNIT II

Folliculogenesis, oogenesis and ovulation and associated endocrine pattern, manipulation of follicular waves, synchronization of estrus and ovulation and induction of ovarian activity.

UNIT III

Gamete transport, fertilization, implantation and maternal recognition of pregnancy.

UNIT IV

Embryonic and fetal development, placentation, fetal circulation and gestation, position of fetus in the uterus, age characteristics of fetus.

UNIT V

Pregnancy diagnosis: clinical, ultrasonographic, endocrinological and other diagnostic laboratory tests. Pseudo-pregnancy and its treatment.

UNIT VI

Factors affecting reproduction – seasonality, nutrition, stress, environment, management, suckling and diseases.

UNIT VII

Lactation and artificial induction of lactation.

Practical

Clinical examination of female genitalia. Biometry of female genital organs. Rectal and vaginal examination to diagnose cyclic phases of estrous cycle. Fern pattern of cervical mucus and exfoliated vaginal cytology. Pregnancy diagnosis in large and small animals by various methods. Estimation of age of the fetus. Use of ultrasound / RIA / ELISA in gynaecology. Synchronization of estrus and ovulation in farm animals.

Suggested Readings

Cupps PT. 1991. *Reproduction in Domestic Animals*. Academic Press.
Hafez ESE. 2000. *Reproduction in Farm Animals*. Lippincott, Williams & Wilkins.

Pubedam MH & Pubedam MH. 2003. *McDonald's Veterinary Endocrinology and Reproduction*. Iowa State Press.

Noakes DE, Parkinson DJ & England GCW. 2001. *Arthurs Veterinary Reproduction and Obstetrics*. Saunders Harcourt India.

Roberts SJ. 1976. *Veterinary Obstetrics and Genital Diseases*. Scientific Book Agency.

VGO 602

FEMALE INFERTILITY

3+1

Objective

To impart knowledge and training in diagnosis and treatment of infertility in female domestic animals.

Theory

UNIT I

Introduction to infertility, classification, economic impact. Anatomical causes of infertility, congenital and hereditary causes and acquired defects.

UNIT II

Nutritional causes of infertility. Importance of body condition score.

UNIT III

Managemental and environmental causes of infertility. Out of season breeding.

UNIT IV

Infectious causes of female infertility, specific and non-specific infections.

UNIT V

Ovarian dysfunction: anoestrus, cystic ovarian degeneration, anovulation, delayed ovulation and luteal insufficiency.

UNIT VI

Repeat breeding: its causes, diagnosis and treatment.

UNIT VII

Early embryonic death (EED): causes, diagnosis and therapeutic management.

UNIT VIII

Abortion: infectious and non-infectious causes, diagnosis and prevention of abortion.

UNIT IX

Interactions in Immunological mechanisms and infertility.

Practical

Record keeping, herd fertility assessment and management, diagnosis and treatment of infertility in female animals, use of uterine swabs for bacterial and fungal culture, histo-pathological evaluation of uterine biopsy, exfoliated vaginal cytology and hormone assay. Use of ultrasonography in diagnosis of infertility. Immuno diagnostic techniques.

Suggested Readings

Laing JA. 1979. *Fertility and Infertility in Domestic Animals*. English Language Book Soc. & Bailliere Tindall.

Morrow DA. 1986. *Current Therapy in Theriogenology*. WB Saunders.

Noakes DE, Parkinson DJ & England GCW. 2001. *Arthurs Veterinary Reproduction and Obstetrics*. Saunders Harcourt India.

Roberts SJ. 1976. *Veterinary Obstetrics and Genital Diseases*. Scientific Book Agency.

V GO 603

VETERINARY OBSTETRICS

2+2

Objective

To impart knowledge and training on problems of pregnancy and parturition and their management in domestic animals.

Theory

UNIT I

Parturition: stages of parturition, mechanism of initiation of parturition, hormonal profiles associated with parturition.

UNIT II

Principles of handling of dystocia, obstetrical procedures: mutations, fetotomy, caesarean section. Obstetrical anesthesia and analgesia, epidural anesthesia.

UNIT III

Fetal and maternal dystocia: causes, diagnosis and management.

UNIT IV

Uterine torsion: causes, diagnosis and its correction.

UNIT V

Diseases and accidents during gestation and around parturition.

UNIT VI

Etiology, diagnosis and treatment of ante-partum and post-partum uterine and vaginal prolapse.

UNIT VII

Induction of parturition and elective termination of pregnancy.

UNIT VIII

Involution of uterus following normal and abnormal parturition.

UNIT IX

Care of dam and the newborn.

Practical

Pelvimetry of different species of farm animals. Diagnosis and correction of abnormal fetal presentation, position and posture in phantom box. Epidural anesthesia, ovariohysterectomy and caesarean operation. Fetotomy exercises. Detorsion of uterus. Management of prolapse. Handling of clinical cases of dystocia.

Suggested Readings

- Arthur GH, Pearson H & Noakes DE. 2000. *Veterinary Reproduction and Obstetrics*. English Language Book Society & Bailliere Tindall.
- Roberts SJ. 1976. *Veterinary Obstetrics and Genital Diseases*. Scientific Book Agency.
- Sloss V & Dufty JH. 1980. *Handbook of Bovine Obstetrics*. Williams & Wilkins.

VGO 604

ANDROLOGY AND MALE INFERTILITY

3+1

Objective

To impart knowledge and training about male reproduction and treatment of male infertility in domestic animals.

Theory

UNIT I

Structure and function of reproductive tract of male.

UNIT II

Sexual behavior and examination of bulls for breeding soundness.

UNIT III

Spermatogenesis, (formation, migration, maturation and ejaculation of semen), fine structure of spermatozoa, semen and its composition.

UNIT IV

Diseases transmitted through semen.

UNIT V

Factors affecting semen quality, semen culture, tests for assessment of sperm motility, sperm survival and fertilizing capacity of spermatozoa.

UNIT VI

Causes of infertility: hereditary, congenital, infectious, nutritional and hormonal. Pathological and functional disturbances of epididymis, vas deferens and accessory sex glands.

UNIT VII

Impotentia cocundi and impotentia generandi. Testicular hypoplasia and degeneration: causes and affect on semen and fertility.

UNIT VIII

Coital injuries and vices of male animals.

Practical

General and rectal examination for biometrics of male genitalia and accessory sex glands. Breeding soundness evaluation of male animals. Semen evaluation for sperm abnormalities, fertility and determination of other biochemical constituents of seminal plasma. Computer assisted semen analysis (CASA), Microbiological load of semen. Examination, diagnosis and treatment of infertile male animals.

Suggested Readings

Hafez ESE. 2000. *Reproduction in Farm Animals*. Lippincott, Williams & Wilkins.

Mann T & Lutwak-Mann C. 1981. *Male Reproductive Function and Semen*. Springer-Verlag.

Morrow DA. 1986. *Current Therapy in Theriogenology*. WB Saunders.

Roberts SJ. 1976. *Veterinary Obstetrics and Genital Diseases*. Scientific Book Agency

Salisbury GW, VanDemark NL & Lodge JR. 1978. *Physiology of Reproduction and Artificial Insemination of Cattle*. WH Freeman & Co.

VGO 605

SEMEN PRESERVATION AND ARTIFICIAL INSEMINATION

2+1

Objective

To impart knowledge and training about collection, evaluation and preservation of semen and artificial insemination (AI) in domestic animals.

Theory

UNIT I

History of artificial insemination.

UNIT II

Methods of semen collection.

UNIT III

Semen evaluation: macroscopic, microscopic, biochemical and microbiological tests, Computer assisted semen analysis (CASA).

UNIT IV

Semen preservation. Extenders for preservation of semen at different temperatures. Semen additives for enhancement of motility and fertilizing capacity of spermatozoa.

UNIT V

Cryopreservation of semen. Effects of cryopreservation on spermatozoa, semen quality and fertility.

UNIT VI

Thawing protocols of frozen semen. Factors affecting post-thaw semen quality.

UNIT VII

Ideal protocol for AI in different species of animals. Factors affecting success of AI.

Practical

Computer assisted semen analysis (CASA), Collection and evaluation of semen. Preparation of extenders. Preservation of semen: room temperature, refrigeration and cryopreservation. Handling and evaluation of processed semen. Practice of AI techniques.

Suggested Readings

Hafez ESE. 2000. *Reproduction in Farm Animals*. Lippincott, Williams & Wilkins.

Perry J. 1970. *Artificial Insemination of Farm Animals*. Oxford & IBH.

Salisbury GW, VanDemark NL & Lodge JR. 1978. *Physiology of Reproduction and Artificial Insemination of Cattle*. WH Freeman.

VGO 606

REPRODUCTIVE BIOTECHNOLOGY

2+1

Objective

To impart knowledge and training on biotechniques in animal reproduction.

Theory

UNIT I

Embryo transfer technology: selection of donors and recipients.

UNIT II

Synchronization, super-ovulation, surgical and non-surgical collection of embryos and evaluation of embryos.

UNIT III

Cryopreservation of embryos, transfer of embryos to donors.

UNIT IV

In vitro fertilization, *in vitro* maturation, micromanipulation of embryos.

UNIT V

Sexing of sperm and embryos.

UNIT VI

Transgenic animals. Chimeras.

UNIT VII

Stem cell biotechnology

UNIT VIII

Immuno-neutralization of hormones. Immunomodulation of fertility.

Practical

Synchronization of estrus in donors and recipients, superovulation, surgical and non-surgical collection and transfer of embryos. Collection of oocytes from slaughter house genitalia. *In vitro* fertilization, *in vitro* maturation and cryopreservation of embryos. Sexing of embryos.

Suggested Readings

Gordon I. 2004. *Reproductive Technologies in Farm Animals*. CABI.

Hafez ESE. 2000. *Reproduction in Farm Animals*. Lippincott, Williams & Wilkins.

VGO 607 CLINICAL PRACTICE - I 0+3

Objective

Hands-on training on diagnosis and treatment of reproductive disorders in animals in TVCSC.

Practical

Clinical examination of animals affected with reproductive disorders, use of diagnostic techniques for diagnosis and institution of required therapy. Maintenance of case records. Presentation on selected /assigned cases.

Suggested Readings

Morrow DA. 1986. *Current Therapy in Theriogenology*. WB Saunders.

VGO 608 CLINICAL PRACTICE – II 0+3

Objective

Hands-on training on diagnosis and treatment of reproductive disorders in animals in TVCSC.

Practical

Clinical examination of animals affected with reproductive disorders, use of diagnostic techniques for diagnosis and institution of required therapy. Maintenance of case records. Presentation on selected /assigned cases.

Suggested Readings

Morrow DA. 1986. *Current Therapy in Theriogenology*. WB Saunders.

Suggested Broad Topics for Master's Research

- * Anoestrus: Endocrinological investigations
- * Reproductive biotechnology
- * Investigations into andrological problems
- * Management of obstetrical problems

14. VETERINARY MEDICINE
Course Structure – at a Glance

Sl. No.	Course No.	Course Title	Credits
1.	VMD 601	Ruminant Clinical Medicine – I	2 + 1 = 3
2.	VMD 602	Canine and Feline Clinical Medicine	2 + 0 = 2
3.	VMD 603	Production and Deficiency Diseases of Livestock and Pet Animals	2 + 0 = 2
4.	VMD 604	Diseases of Domestic Animals caused by Toxicants	1 + 0 = 1
5.	VMD 605	Veterinary Emergency and Critical Care	1 + 1 = 2
6.	VMD 606	Infectious Diseases of Ruminants - I	2 + 1 = 3
7.	VMD 607	Infectious Diseases of Ruminants - II	2 + 1 = 3
8.	VMD 608	Canine Dermatology	2 + 0 = 2
9.	VMD 609	Avian Diseases	1 + 1 = 2
10.	VMD 610	Advances in Prevention and Control of Diseases in Pet Animals	1 + 1 = 2
11.	VMD 611	Clinical Practice – I	0 + 3 = 3
13.	VMD 612	Clinical Practice – II	0 + 3 = 3
14.	VMD 691	Masters' Seminar	1 + 0 = 1
15.	VMD 699	Masters' Research	20

List of Minor Subjects

MAJOR SUBJECT	MINOR SUBJECTS
Veterinary Medicine	Veterinary Surgery and Radiology, Veterinary Microbiology, Veterinary Parasitology, Veterinary Pathology, Veterinary Pharmacology & Toxicology

VETERINARY MEDICINE

Course Contents

- VMD 601 Ruminant Clinical Medicine - I** **2 + 1 = 3**
- Theory: Etio-pathogenesis, clinical manifestations, diagnosis, differential diagnosis, treatment and prevention of diseases of alimentary system, liver, respiratory system and cardiovascular system of farm animals.
- Practicals: General clinical examination of various organ systems of the body, physical methods of diagnosis- Palpation, percussion and auscultation of various body systems. Liver biopsy and other liver function tests, ECG and its interpretation, endoscopy, ultrasonography and echocardiography. Collection and laboratory examination of rumen liquor. Examination of various secretions and excretions for laboratory diagnosis and clinical case records.
-
- VMD 602 Canine and Feline Clinical Medicine** **2 + 0 = 2**
- Theory: Diseases of digestive system, liver and pancreas, respiratory system, cardiovascular system, blood and blood-forming organs, diseases of the urinary and nervous systems.
-
- VMD 603 Production and Deficiency Diseases of Livestock and Pet animals** **2 + 0 = 2**
- Theory: Metabolic profile testing in farm animals, etio-pathogenesis, clinical manifestations, diagnosis, differential diagnosis, treatment and prevention of parturient paresis, lactation tetany of mares, eclampsia of bitches, Downer's cow, hypomagnesemic tetany, post-parturient haemoglobinuria, ketosis, fat cow syndrome, pregnancy toxemia, osteodystrophia fibrosa, azoturia of equines, rheumatism-like syndrome in buffaloes, hypothyroidism, diabetes mellitus in dogs. Deficiency diseases caused by calcium, phosphorus, magnesium, iron, copper, cobalt, zinc, manganese, iodine, fat and water soluble vitamins.
-
- VMD 604 Diseases of Domestic Animals Caused by Toxicants** **1 + 0 = 1**
- Theory: Management of diseases caused by various toxicants in domestic animals - physical agents and poisoning caused by farm chemicals, phytotoxins, mycotoxins and zootoxins. Management of diseases caused by poisonous plants, poisonous snakes and insect bites.

VMD 612	Clinical Practice – II	0 + 3 = 3
	Application of the theoretical concepts in practice. Diagnostic procedures in Veterinary practice, and therapeutic protocol application, specimen collection, examination and management of sick farm and companion animals. Note: This course shall be conducted in TVCC (College Clinics), where students shall participate in diagnosis and treatment of diseased animals).	
VMD 691	Masters' Seminar	1 + 0 = 1
VMD 699	Research	20 credits

REFERENCES

1. Radostitis, O.M., Gay, C.C., Hinchcliff, K.W. and Constable, P.D. 2006. *Veterinary Medicine*. A textbook of the diseases of Cattle, Sheep, Pigs, Goats and Horses. Tenth edn. Book Power – WB Saunders, London, U.K.
2. Ettinger, S. J and Feldman E.C .2004. Text book of Veterinary Internal Medicine.6th Edn. Vol.1 and Vol. 2, W.B. Saunders, London,U.K
3. Greene, C.E 2011. Infectious Diseases of the Dog and Cat.4th edn. W.B. Saunders Company, London, U.K
4. Scott, D.W, Miller, W.T., Jr. and Griffin, C.E. 2000. Muller and Kirk's Small Animal Dermatology. 6th edn. Elsevier Health
5. Geo. F. Boddie. 2000. Diagnostic Methods in Veterinary Medicine.5th edn. Greenworld Publishers, Lucknow.
6. Amalendu Chakrabarti. 1988. A textbook of Preventive Veterinary Medicine. Kalyani Publishers, New Delhi.
7. Wintzer H. 1986. *Equine diseases*. Verlaug Paul Parey.
8. Dunn JK. 1999. *Text Book of Small Animal Medicine*. WB Saunders.
9. Straw BF. (Eds.). 1999. *Diseases of Swine*. 8th Ed. Iowa State Univ. Press.

15. VETERINARY SURGERY AND RADIOLOGY

Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
VSR 601	PRINCIPLES OF SURGERY	2+0
VSR 602	CLINICAL PRACTICE – I	0+3
VSR 603	CLINICAL PRACTICE – II	0+3
VSR 604	SMALL ANIMAL ANAESTHESIA	2+1
VSR 605	LARGE ANIMAL ANAESTHESIA	2+1
VSR 606	DIAGNOSTIC IMAGING TECHNIQUES	2+1
VSR 607	VETERINARY OPHTHALMOLOGY AND DENTISTRY	1+1
VSR 608	SMALL ANIMAL SOFT TISSUE SURGERY	2+1
VSR 609	LARGE ANIMAL SOFT TISSUE SURGERY	2+1
VSR 610	ORTHOPAEDIC AND LIMB SURGERY	2+1
VSR 691	MASTER'S SEMINAR	1+0
VSR 699	MASTER'S RESEARCH	20

Major Subject	Minor Subjects*
Veterinary Surgery and Radiology	Veterinary Anatomy , Veterinary Medicine, Veterinary Pharmacology & Toxicology, Veterinary Physiology, Veterinary Pathology, Veterinary Gynaecology and Obstetrics

*The choice of minor courses other than those listed above, may be allowed on the recommendations of advisory committee, if essentially required as per the research problem, with the concurrence of Head of the department and Dean post graduate studies.

VETERINARY SURGERY AND RADIOLOGY

Course Contents

VSR 601	PRINCIPLES OF SURGERY	2+0
Objective	To impart the basic knowledge of principles of surgery.	
Theory	<u>UNIT I</u> Wound healing, current concepts of inflammation and management, wound infections, antimicrobial therapy, principles of surgical asepsis, sterilization and disinfection.	
	<u>UNIT II</u> Systemic effects of surgical stress, haemorrhage and haemostasis, metabolism of the surgical patient, fluid therapy in surgical patients, acid-base balance, shock. Hyperalimentionation. Blood transfusion. Host defense mechanism.	
	<u>UNIT III</u> Biomaterials, surgical immunity, pre -operative assessment of the surgical patient, post-operative care of the surgical patient. Chemotherapy of tumors.	
	<u>UNIT IV</u> Operating room emergencies, cardio-pulmonary embarrassment and resuscitation, monitoring of surgical patient.	
	<u>UNIT V</u> Principles of laser surgery, cryosurgery, electrosurgery, lithotripsy and endoscopy, physiotherapy, stem cell therapy etc.	
Suggested Readings	Fossum TW. (Ed.). 2002. <i>Small Animal Surgery</i> . Mosby. Slatter DH. (Ed.). 2002. <i>Textbook of Small Animal Surgery</i> . WB Saunders.	
VSR 602	CLINICAL PRACTICE – I	0+3
Objective	To impart practical training in anaesthesia, diagnostic imaging techniques and surgery.	
Practical	Client management, public relations, code of conduct, management of surgical affections, designing of surgical hospital, hospital management, database management, attending surgical cases, surgical facilities, equipments, disaster management.	
Suggested Readings	Auer JA. (Ed.). 2006. <i>Equine Surgery</i> . WB Saunders. Fossum TW. (Ed.). 2002. <i>Small Animal Surgery</i> . Mosby. Fubini SL & Ducharme NG. (Ed.). 2004. <i>Farm Animal Surgery</i> . WB Saunders. Slatter DH. (Ed.). 2002. <i>Textbook of Small Animal Surgery</i> . WB Saunders.	
VSR 603	CLINICAL PRACTICE – II	0+3
Objective	To impart practical training in surgery, anaesthesia and diagnostic imaging techniques.	

Practical

Client management, animal welfare and rehabilitation, public relations, code of conduct, management of surgical affections, designing of surgical hospital, hospital management, database management, attending surgical cases, surgical facilities, equipments and personnel, disaster management.

Suggested Readings

- Auer JA. (Ed.). 2006. *Equine Surgery*. WB Saunders.
Fossum TW. (Ed.). 2002. *Small Animal Surgery*. Mosby.
Fubini SL & Ducharme NG. (Ed.). 2004. *Farm Animal Surgery*. WB Saunders.
Slatter DH. (Ed.). 2002. *Textbook of Small Animal Surgery*. WB Saunders.

VSR 604

SMALL ANIMAL ANAESTHESIA

2+1

Objective

To impart the basic and practical knowledge of principles of companion animal anaesthesia.

Theory

UNIT I

General considerations for anaesthesia, peri-operative and post-operative pain and its management.

UNIT II

Sedation: analgesia and pre-medication, anaesthetic agents (injectable anaesthetics, dissociative anaesthetics, inhalation anaesthetics), muscle relaxants, neuromuscular blocking agents and local analgesia.

UNIT III

Anaesthetic techniques, anaesthetic equipments, artificial ventilation.

UNIT IV

Anaesthesia of small animals, pediatric and geriatric patients, birds.

UNIT V

Monitoring of anaesthesia, anaesthetic emergencies, complications and their management, euthanasia.

Practical

Anaesthetic equipments and instrumentation, artificial ventilation, use of various preanaesthetic and anaesthetic agents in small animals, anaesthetic triad, balanced anaesthesia, total intravenous anaesthesia.

Suggested Readings

- Hall LW & Clarke KW. (Eds.). 1991. *Veterinary Anaesthesia*. Bailliere Tindall.
Paddleford RR. (Ed.). 1999. *Manual of Small Animal Anesthesia*. 2nd Ed. WB Saunders.
Thurmon JC, Tranquilli WJ & Benson JG. (Eds.). 1996. *Lumb and Jone's Veterinary Anaesthesia*. Williams & Wilkins.
Thurmon JC, Tranquilli WJ & Benson JG. (Eds.). 1999. *Essentials of Small Animal Anesthesia and Analgesia*. Lippincott Williams & Wilkins.

VSR 605

LARGE ANIMAL ANAESTHESIA

2+1

Objective

To impart the basic and practical knowledge of principles of farm animal anaesthesia and mechanism of pain.

Theory

UNIT I

General considerations for anaesthesia, peri-operative pain, and post-operative pain and its management.

UNIT II

Pre-anaesthetic and anaesthetic adjuncts, injectable anaesthetics, dissociative anaesthetics, inhalation anaesthetics.

UNIT III

Local anaesthetics, neuromuscular blocking agents.

UNIT IV

Anaesthetic techniques, anaesthetic machines, breathing systems, artificial ventilation.

UNIT V

Monitoring of anaesthesia, anaesthetic emergencies and complications, anaesthesia of pediatric and geriatric patients, euthanasia.

Practical

Anaesthetic equipments and instrumentation, artificial ventilation, use of various preanaesthetic and anaesthetic agents in large animals, anaesthetic triad, balanced anaesthesia, total intravenous anaesthesia.

Suggested Readings

Hall LW & Clarke KW. (Eds.). 1991. *Veterinary Anaesthesia*. Bailliere Tindall.

Muir WW & John AE. (Eds.). 1991. *Equine Anesthesia*. Mosby.

Thurmon JC, Tranquilli WJ & Benson JG. (Eds.). 1996. *Lumb and Jone's Veterinary Anaesthesia*. Williams & Wilkins.

VSR 606

DIAGNOSTIC IMAGING TECHNIQUES

2+1

Objective

To impart the basic and practical knowledge of principles of diagnostic imaging techniques and interpretation of radiographs, ultrasonograph/CT/MRI and other imaging techniques.

Theory

UNIT I

Conventional and digital X-ray machine, quality of radiation, formation of radiograph technique chart, artifacts and their prevention, special diagnostic radiographic procedures, radiographic quality, radiographic accessories, differentiation of radiographic densities in relation to clinical diagnosis.

UNIT II

Principles of radiographic interpretation, plain and contrast radiographic techniques of small and large animals, image intensification.

UNIT III

Principles of radiation therapy, medical radioisotope curves, radiation laws and regulations.

UNIT IV

Principles of ultrasound, basic physics, transducers, equipment controls, display models, terminology of echotexture and artifacts, application of ultrasound in small and large animals.

UNIT V

Doppler techniques echocardiography and its application, introduction to MRI, CT scan, nuclear medicine, xeroradiography, positron emission tomography technique and other imaging techniques.

UNIT VI

Electromagnetic radiations, hazards of electromagnetic radiations and protection and bio-safety.

Practical

Acquaintance with imaging equipments, dark room processing techniques and X-ray film handling, formulation of technique chart with fixed kVp and variable mAs, basics of radiographic interpretation of diseases, computer aided image acquisition and retrieval, radiographic positioning of different regions in domestic animals, angiography, cardiac catheterization and other contrast radiographic techniques of different types, interpretation of ultrasonographs, MRI, CT scans etc.

Suggested Readings

- Bargai U, Bharr, JW & Morgan JP. (Eds.). 1989. *Bovine Radiology*. Iowa State University Press, Ames.
- Bushong SC. (Ed.). 1975. *Radiologic Science for Technologists*. CV Mosby.
- Gillette EL, Thrall DE & Lebel JL. (Eds.). 1977. *Carlson's Veterinary Radiology*. Lea & Febiger.
- Goddard PJ. (Ed.). 1995. *Veterinary Ultrasonography*. CABI.
- Kealy JK. (Ed.). 1987. *Diagnostic Radiology and Ultrasonography in Dogs and Cats*. 2nd Ed. Saunders, Philadelphia.
- Morgan JP. (Ed.). 1972. *Radiology in Veterinary Orthopaedics*. Lea & Febiger.
- Singh AP & Singh J. (Eds.). 1994. *Veterinary Radiology*. CBS.
- Thrall DE. (Ed.). 2007. *Textbook of Veterinary Diagnostic Radiology*. 5th Ed. Saunders, Philadelphia.

VSR 607 VETERINARY OPHTHALMOLOGY AND DENTISTRY 1+1

Objective

To impart the basic and practical knowledge of diagnosis and treatment of diseases of eye and teeth in domestic animals.

Theory

UNIT I

General Anatomical and physiological considerations for ophthalmic surgery.

UNIT II

Ophthalmic examination and diagnosis, local anaesthesia of eye, ocular therapeutics, diagnostic instruments.

UNIT III

General consideration for eye surgery, diseases and surgery of eye lids, lacrimal apparatus, naso-lacrimal duct.

UNIT IV

Diseases of conjunctiva, cornea, sclera, iris, orbit, lens, vitreous and aqueous humor, retina and optic nerve.

UNIT V

Ocular manifestation of systemic diseases.

UNIT VI

Anatomy of teeth, examination of teeth. Diseases of teeth- congenital anomalies (retained deciduous teeth, impacted teeth, abnormalities in the shape of teeth). Diseases of teeth- acquired diseases (dental caries, fracture of teeth, endodontic disease, dental materials and dental radiography). Restorative dentistry, periodontal disease, tooth extraction, gum diseases. Current techniques in dentistry.

Practical

Ophthalmic instrumentation, examination of the eye and its adnexa, preparation of patient for eye anaesthesia and surgery, canthotomy, tarsorrhaphy, transplantation of cornea, keratoplasty, anterior chamber paracentesis, flushing of naso-lacrimal duct, iridectomy, lens extraction/implantation. Dentistry instrumentation, dental radiography, teeth cleaning, tooth extraction.

Suggested Readings

- Gelatt KN. (Ed.). 1981. *Veterinary Ophthalmology*. Lea & Febiger.
Gelatt KN. (Ed.). 2007. *Atlas of Veterinary Ophthalmology*. 4th Ed. Blackwell Publ.
Gelatt KN. (Ed.). 2000. *Essentials of Veterinary Ophthalmology*. Blackwell.
Lavach JD. (Ed.). 1990. *Large Animal Ophthalmology*. CV Mosby.
Oehme FW & Prier JE. (Eds.). 1974. *Textbook of Large Animal Surgery*. Williams & Wilkins.
Slatter DH. (Ed.). 1981. *Fundamentals of Veterinary Ophthalmology*. WB Saunders.
Tyagi RPS & Singh J. (Eds.). 1993. *Ruminant Surgery*. CBS.

VSR 608

SMALL ANIMAL SOFT TISSUE SURGERY

2+1

Objective

To familiarize with various surgical affections of different body systems and their treatment in small animals.

Theory

UNIT I

Skin and adnexa- the integument, management of skin wounds, principles of plastic and reconstructive surgery, pedicle grafts, skin grafts, burns, electrical chemical and cold injuries.

UNIT II

Surgical approaches/ affections of ear, oral cavity and pharynx, abdomen, thorax, the salivary glands, oesophagus, stomach, intestines, rectum and anus, liver and biliary system, pancreas.

UNIT III

Hernias - abdominal hernia, diaphragmatic hernia, perineal hernia, inguinal, scrotal, and umbilical hernia etc. Surgical approaches to thoracic wall, Pleura.

UNIT IV

Respiratory system- functional anatomy, diseases of upper respiratory system and lower respiratory system.

UNIT V

Surgical anatomy of the cardiovascular system, cardiovascular physiology, diagnostic methods, cardiac disorders, principles of vascular surgery, basic cardiac procedures, hypothermia, basic peripheral vascular procedures, peripheral vascular disorders, portacaval shunts and anomalies. Haemolymphatic system, bone marrow, spleen, tonsils, lymph nodes and lymphatics, thymus.

UNIT VI

Male reproductive system- anatomy of the male genital organs, diagnostic and biopsy techniques, surgical affections of male genital organs; female reproductive system- anatomy, diagnostic techniques, surgical affections of female genital organs.

UNIT VII

Urinary system- anatomy of the urinary tract, principles of urinary tract surgery, kidneys, ureters, surgery of the bladder, surgical diseases of the urethra, medical dissolution and prevention of canine uroliths, feline urologic syndrome.

UNIT VIII

Endocrine system- pituitary, adrenals, thyroid, parathyroid, surgical affections of mammary glands and tail. Surgical affections of nervous system, special sense organs.

Practical

Practice of various surgical techniques of skin and adnexa, alimentary system, hernias, respiratory system, cardiovascular system, male and female reproductive systems, urinary system, mammary glands and tail.

Suggested Readings

Fossum TW. (Ed.). 2002. *Small Animal Surgery*. Mosby.

Slatter DH. (Ed.). 2002. *Textbook of Small Animal Surgery*. WB Saunders.

VSR 609

LARGE ANIMAL SOFT TISSUE SURGERY

2+1

Objective

To familiarize with various surgical affections of different body systems and their treatment in large animals.

Theory

UNIT I

Abdominal wall, integumentary system - skin and appendages; mammary gland, tail, affections of oral cavity.

UNIT II

Surgical affections of respiratory system, cardiovascular and lymphatic system.

UNIT III

Surgical affections of digestive system, urinary and genital system.

UNIT IV

Surgical affections of nervous system, special sense organs.

Practical

Practice of various surgical techniques of skin, alimentary system, hernias, respiratory system, cardiovascular system, male and female reproductive system, urinary system, mammary glands and tail. Surgical affections of nervous system, special sense organs.

Suggested Readings

- Auer JA. (Ed.). 2006. *Equine Surgery*. WB Saunders.
Fubini SL & Ducharme NG. (Eds.). 2004. *Farm Animal Surgery*. WB Saunders.
Oehme FW & Prier JE. (Ed.). 1994. *Textbook of Large Animal Surgery*. Williams & Wilkins.
Tyagi RPS & Singh J. (Eds.). 1993. *Ruminant Surgery*. CBS.

VSR 610

ORTHOPAEDICS AND LIMB SURGERY

2+1

Objective

To familiarize with various affections of bones, joints, tendons, ligaments and foot as well as their treatment in animals.

Theory

UNIT I

Fractures and dislocations, fracture healing, ligaments and tendons - repair techniques.

UNIT II

Treatment of fractures of different bones in domestic animals, bone diseases.

UNIT III

Various affections of the joints, their diagnosis and treatment.

UNIT IV

Conformation of the limb, anatomy of hoof.

UNIT V

Lameness and allied surgical conditions of fore limbs/hind limbs, rehabilitation of orthopaedic patient.

Practical

Internal and external fixation of fractures and dislocation, arthrotomy, tenotomy, examination of limbs for lameness, nerve blocks, injections in joints, operations for arthritis, hoof surgery and corrective shoeing, physiotherapy. Instrumentation, neurological examination, imaging the spine; skull and brain, surgical approach to the cervical spine; thoracolumbar spine and brain.

Suggested Readings

- Auer JA. (Ed.). 2006. *Equine Surgery*. WB Saunders.
Fubini SL & Ducharme NG. (Eds.). 2004. *Farm Animal Surgery*. WB Saunders.
Newton CD & Nunamaber DM. (Eds.). 1985. *Textbook of Small Animal Orthopaedics*. JB Lippincott.
Oehme FW & Prier JE. (Eds.). 1974. *Textbook of Large Animal Surgery*. Williams & Wilkins.
Tyagi RPS & Singh J. (Eds.). 1993. *Ruminant Surgery*. CBS.

Suggested Broad Topics for Master's Research

- * Evaluation of preanaesthetics and anaesthetics in domestic animals
- * Management of pain in animals
- * Surgical Management of gastrointestinal tract disorders in bovines
- * Management of fractures in animals
- * Ultrasonography of soft organs of large and small animals

16.VETERINARY AND ANIMAL HUSBANDRY EXTENSION EDUCATION

Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
AHE 601	FUNDAMENTALS OF VETERINARY AND ANIMAL HUSBANDRY EXTENSION	2+1
AHE 602	COMMUNICATION FOR LIVESTOCK DEVELOPMENT	1+1
AHE 603	DIFFUSION AND ADOPTION OF ANIMAL HUSBANDRY PRACTICES	2+1
AHE 604	EXTENSION TECHNIQUES AND AUDIO VISUAL AIDS	2+1
AHE 605	ANIMAL HUSBANDRY PROGRAMME PLANNING AND EVALUATION	2+1
AHE 606	RESEARCH METHODOLOGY IN VETERINARY AND ANIMAL HUSBANDRY EXTENSION	2+1
AHE 607	SOCIAL PSYCHOLOGY AND GROUP DYNAMICS	2+1
AHE 608	ANIMAL HUSBANDRY DEVELOPMENT PROGRAMMES	1+0
AHE 609	DEVELOPMENTS IN THE CONCEPT OF EXTENSION	1+0
AHE 610	HUMAN RESOURCE MANAGEMENT IN ANIMAL HUSBANDRY SECTOR	2+1
AHE 611	GENDER AND LIVESTOCK DEVELOPMENT	1+0
AHE 612	INFORMATION AND COMMUNICATION TECHNOLOGY IN LIVESTOCK DEVELOPMENT	1+1
AHE 691	MASTER'S SEMINAR	1+0
AHE 699	MASTER'S RESEARCH	20

Major Subject	Minor Subjects*
Veterinary and Animal Husbandry Extension	Veterinary Public Health, Veterinary Gynecology & Obstetrics, Livestock Production and Management. Animal Nutrition, Animal Genetics & Breeding.

* The choice of minor courses other than those listed above, may be allowed on the recommendations of advisory committee, if essentially required as per the research problem, with the concurrence of Head of the Department and Dean, Post Graduate Studies

VETERINARY AND ANIMAL HUSBANDRY EXTENSION EDUCATION

Course Contents

AHE 601 **FUNDAMENTALS OF VETERINARY AND** **2+1**
ANIMAL HUSBANDRY EXTENSION

Objective

To acquaint the students with the genesis, development and present status of animal husbandry extension and linkages among departments and various institutions.

Theory

UNIT I

Concept, philosophy, principles, genesis, growth and scope of extension education.

UNIT II

Earlier extension efforts and their implications. Emerging issues, problems and challenges of animal husbandry extension education.

UNIT III

Extension approaches of State and Central Governments, ICAR, SVUs/SAUs, NGOs and other organizations in delivery of animal husbandry and veterinary services.

UNIT IV

Linkages between researcher-extension agent - livestock farmer-industry in the generation, dissemination and utilization of animal husbandry practices.

Practical

Study of the organizational set-up and functioning of State Animal Husbandry Department and dairy/rural development agencies. Study of indigenous technical know-how about animal husbandry practices in villages.

Suggested Readings

- Adams ME. 1982. *Agricultural Extension in Developing Countries*. Longman, Singapore Publ.
- Burton ES, Robert PB & Andrew JS. 1997. *Improving Agricultural Extension – A Reference Manual*. FAO.
- Dahama OP & Bhatnagar OP. 1987. *Education and Communication for Development*. Oxford & IBH.
- Mosher AT. 1966. *Getting Agriculture Moving- Essentials for Development and Modernization*. Praeger, New York.
- Mosher AT. 1978. *An Introduction to Agricultural Extension*. ADC.
- Owen E, Kitalyi A, Jayasuryia N & Smith T. (Ed). 2005. *Livestock and Wealth Creation – Improving of the Husbandry of Animals Kept by Resource Poor People in Developing Countries*. Nottingham Univ. Press.
- Roling N. 1988. *Extension Science. Information Systems in Agricultural Development*. Cambridge Univ. Press.
- Rivera WM & Schram SG. (Ed). 1987. *Agricultural Extension World wide – Issues, Practices and Emerging Priorities*. Croome Helm, London.
- Rivera WM. & Gustafson DJ. (Ed). 1991. *Agricultural Extension: Worldwide: Institutional Evolution and Forces for Change.* Elsevier.

UNIT II

Concepts and stages of adoption. Adoption models. Adopter categories and their characteristics. Factors influencing adoption. Attributes of innovations, rate of adoption and sources of information. Consequences of adoption of innovations.

UNIT III

Role of change agents in transfer of technology. Diffusion studies in veterinary extension. Role of communication in diffusion and adoption process.

Practical

Study of selected animal husbandry innovations- the adoption and non-adoption of various practices. Reasons for adoption and non-adoption of innovations

Suggested Readings

- Brown Lawrence A. 1981. *Innovation Diffusion: A New Perspective*. Methuen.
- Cragan FJ & Wright WD. 1999. *Communication in Small Groups – Theory, Process, Skills*. Wadsworth Publ.
- Rogers EM. 2003. *Diffusion of Innovations*. Free Press.
- Servaes J, Thomas LJ & White AS. (Ed). 1997. *Participatory Communication for Social Change*. Sage Publ.

AHE 604

EXTENSION TECHNIQUES AND AUDIO VISUAL AIDS 2+1

Objective

To train the students about various techniques/methods for transfer of animal husbandry technologies through suitable audio-visual aids.

Theory

UNIT I

Teaching learning process and its principles. Steps in extension teaching process, cone of experience. Learning situation. Criteria for effective teaching and learning.

UNIT II

Extension approaches in livestock development– individual, group and mass approach (electronic and non electronic). Relative merits and demerits of different teaching methods in animal husbandry extension.

UNIT III

Audio-visual aids– classification, use and evaluation. Selection criteria of audio-visual aids.

UNIT IV

Multi-media projection and computer aided teaching aids for animal husbandry extension.

UNIT V

Selection of different extension methods for dissemination of animal husbandry technologies and media-mix.

Practical

Preparation and presentation of various audio-visual aids. Use of different teaching methods in field situations. Review of research studies in teaching methods and A.V. aids.

Suggested Readings

Dahama OP & Bhatnagar OP. 1987. *Education and Communication for Development*. Oxford & IBH.

Hass KB & Packer HQ. 1962. *Preparation and Use of Audio-Visual Aids*. Prentice Hall.

Mathialagan P. 2005. *Text Book of Animal Husbandry and Livestock Extension*. International Book Distributing Co.

Mody Bella 1992. *Designing Messages for Development Communication. An Audience Participation based Approach*. Sage Publ. Oakley P &

Garforth C. 1985. *Guide to Extension Training*. FAO. Priyanjam Kartik

2005. *Audio Visual Aids and Education*. Dominant Publ. Ray GL. 1991.

Extension, Communication and Management. Naya Prokash.

AHE 605

ANIMAL HUSBANDRY PROGRAMME PLANNING AND EVALUATION

2+1

Objective

To expose the students on planning, formulation, implementation and evaluation of various animal husbandry development programmes.

Theory

UNIT I

Importance of programme planning in veterinary and animal husbandry extension. Objectives, principles and steps in programme planning process. Role of animal husbandry extension agencies, local leaders, livestock owners and institutions in planning and implementation of need-based veterinary extension programmes.

UNIT II

Genesis, nature and principles of planning. Planning Commission and its role. Five Year Plans with reference to animal husbandry development. Organizational structure for planning at different levels.

UNIT III

Concept, principles, types and methods of evaluation. Importance of monitoring various livestock development programmes.

UNIT IV

Needs assessment– meaning, importance, classification and steps. Concept of FSR, Participatory Approaches- Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA)

UNIT V

Project management techniques- Programme Evaluation and Review Technique (PERT). Critical Path Method (CPM). Project formulation. Project appraisal in terms of social benefit analysis, logical frame work.

Practical

Preparation of livestock development plan for a village. Developing instruments for monitoring and evaluation of on-going development programme at village level (Logical Frame Work). Exercises on Participatory approaches (RRA,PRA, Case study, Problem Based Learning).

Suggested Readings

Collinson M. 2000. *A History of Farming System Research*. CAB Publ.

- Dantwala ML & Beroneda JN. 1990. *Rural Development, Approaches and Issues in Indian Agricultural Development since Independence*. Oxford & IBH.
- Penders JMA. 1958. *Methods and Programme Planning in Rural Extension*. Veenman & Zonen.
- Swanson BE. (Ed). 1997. *Agricultural Extension: A Reference Manual*. FAO.
- Thyagrajan M. 1982. *Project Management through Network Techniques (PERTCPM)*. Indian Institute of Public Administration, New Delhi.
- White Shirley (Ed). 1999. *The Art of Facilitating Participation – Releasing the Power of Grassroots Communication*. Sage Publ.

AHE 606

**RESEARCH METHODOLOGY IN VETERINARY 2+1
AND ANIMAL HUSBANDRY EXTENSION**

Objective

To apprise the students about the selection criteria of research problem, variables, research design, sampling techniques, data collection procedure and report writing in the field of animal husbandry extension.

Theory

UNIT I

Concept, nature and scope of research in social sciences. Types of research- fundamental, applied and action research, experimental and non-experimental research. Variables, types and their measurement. Selection and formulation of research problem. Hypothesis– importance, selection criteria (quality of workable hypothesis), formulation and testing of hypothesis.

UNIT II

Measurement and levels of measurement; Research designs- exploratory, experimental, and ex-post-facto research design. Action research. Sampling methods- probability and non-probability sampling. Sources of errors.

UNIT III

Methods of data collection– survey method, observation method, interview/questionnaire method, case study, content analysis, sociometry and projective techniques. Action research. Reliability and validity of measurements.

UNIT IV

Social statistics – Parametric and non-parametric. Data processing and analysis. Report writing. Review of studies in social research.

Practical

Selecting a research problem and working it out with all the steps; report writing and presentation of the report.

Suggested Readings

- Arlene Fink (Ed). 2003. *The Survey Kit* (10 booklets). Sage Publ.
- Creswell John W. 1994. *Research Design – Qualitative and Quantitative Approaches*. University of Nebraska, Lincoln.
- Edwards AL. 1969. *Techniques of Attitude Scale Construction*. Vakil, Feffer & Simons
- Garrett HE. 1966. *Statistics in Psychology and Education*. International Book Bureau, Hyderabad.
- Goode WJ & Hatt PK. 1952. *Methods in Social Research*. McGraw-Hill.

- Guilford JP. 1971. *Psychometric Methods*. TATA McGraw Hill.
- Henerson EM, Morris LL. & Gibbon CT. 1987. *How to Measure Attitudes*. Sage Publ.
- Kerlinger FN. 1994. *Foundations of Behavioural Researches*. Holt, Rinehart & Winstons.
- Kumar, R. 1999. *Research Methodology – A Step by Step for Beginners*. Sage Publ.
- Miller Delbert C. 1991. *Handbook of Research Design and Social Measurement*. Indiana University. Sage Publ.
- Oppenheim AN. 1979. *Questionnaire Design and Attitude Measurement*. Heinemann Educational Books.

AHE 607 SOCIAL PSYCHOLOGY AND GROUP DYNAMICS 2+1

Objective

To acquaint the students with the structure and functioning of social groups and socio-psychological aspects in interacting with livestock farmers.

Theory

UNIT I

Meaning, scope and importance of psychology in animal husbandry extension work. Orientation of psychology.

UNIT II

Perception- nature, laws and selectivity in perception, factors in perception, importance of perception in extension work. Attitude- nature, theories, measurement and change of attitude towards livestock owners, formation of stereo types and prejudice, factors in attitude change.

UNIT III

Motivation– nature, characteristics, theories, types and techniques of motivating farm people. Emotion- nature, types of emotional response, theories and role of emotion in regulating the human behaviour. Learning- principles, theories of learning and experiential learning. UNIT IV

Intelligence- nature, theories and measurement. Personality- nature, traits, types, biological and socio-cultural determinants of personality. Group and individual behaviour.

UNIT V

Concept and types of groups; Typology and importance in rural development; Group structures - attraction, coalition, communication and power; Processes in group development and group identity; Factors affecting group performance; Conflicts in groups; Group belongingness.

Practical

Study of structure and functioning of selected Self Help Groups (SHGs), factors influencing the success/ failure of SHGs, Milk Cooperative Societies.

Suggested Readings

- Baron RA. 1995. *Psychology*. Prentice Hall.
- Cragan, FJ & Wright WD. 1999. *Communication in Small Groups – Theory, Process, Skills*. Wadsworth Publ.
- Kagan J & Havemann E. 1980. *Psychology – An Introduction*. Harcourt Brace Javanovich Inc.

- Morgan CT, King RA & Robinson NM. 1979. *Introduction to Psychology*. Tata McGraw-Hill.
- Napier RW & Gershenfeld MK. 2006. *Groups – Theory and Experience*. AITBS Publ.
- Secord PF & Backman CW. 1964. *Social Psychology*. McGraw-Hill.

AHE 608 ANIMAL HUSBANDRY DEVELOPMENT PROGRAMMES 1+0

Objective

To make the students aware of livestock development programmes launched by various agencies.

Theory

UNIT I

Concept of development, social and economic development; Historical overview on Rural Development in India

UNIT II

Ongoing Animal Husbandry Development Programmes - NPCBB, PM assistance livestock development programme, rural development programmes with special reference to livestock- SGSY, EGS

UNIT III

Transfer of Technology (TOT) programmes of ICAR– National Demonstration, Krishi Vigyan Kendra, Trainers’ Training Centres, Lab to Land Programme, Operational Research Project, National Agricultural Research Project, Agricultural Technology Management Agency, National Agricultural Innovative Project.

UNIT IV

Understanding the functioning of livestock development institutions - DRDA, NABARD, Insurance Companies, NGOs.

Suggested Readings

- Candler W & Kumar N. 1998. *India. The Dairy Revolution – The Impact of Dairy Development in India and the World Bank Contribution*. The World Bank.
- Dahama OP & Bhatnagar OP. 1987. *Education and Communication for Development*. Oxford & IBH.
- Govt. of India 2005. *A Reference Manual*. Ministry of Information and Broadcasting, New Delhi. <http://www.dahd.nic.in>
- Mathialagan P. 2005. *Text Book of Animal Husbandry and Livestock Extension*. International Book Distributing Co.
- Ray GL. 1991. *Extension, Communication and Management*. Naya Prokash.

AHE 609 DEVELOPMENTS IN THE CONCEPT OF EXTENSION 1+0

Objective

To acquaint the students with the recent development in extension.

Theory

UNIT I

Important concepts in extension science; various schools of thought; Systems concept in extension.

UNIT II

Changing approaches – Farmer participatory approaches; Global concepts of extension as applied to Indian Context.

UNIT III

Recent trends in extension. Privatisation of extension. Public Private Partnership. Contract farming. Organic animal husbandry. Indicators of livestock sustainability. Animal welfare programmes

UNIT IV

Various stake holders in Livestock development; stakeholder analysis, problem tree

Suggested Readings

Blackburn DJ. 1989. *Foundations and Changing Practices in Extension*. Univ. of Guelph, Canada.

Jones GE. (Ed). 1985. *Investing in Rural Extension: Strategies and Goals*. Elsevier.

Roling N. 1988. *Extension Science*. Cambridge Univ. Press.

AHE 610

HUMAN RESOURCE MANAGEMENT IN ANIMAL HUSBANDRY SECTOR

2+1

Objective

To expose the students in human resource management techniques and dealing with the hierarchical and organizational problems.

Theory

UNIT I

Concept, importance and functions of human resource management. Process of management- planning, organizing, staffing, directing, coordination, reporting and budgeting. Principles, levels and types of organization.

UNIT II

Training– models, methods, identification of training needs, training evaluation and developing strategies for human resource development in animal husbandry sector.

UNIT III

Supervision- meaning, process and techniques. Work motivation. job efficiency and job satisfaction.

UNIT IV

Organizational communication. Organizational climate. Conflict management.

UNIT V

Personnel management in animal husbandry organizations and disaster management.

Practical

Training needs assessment, development of training module, organization, evaluation of a training programme

Suggested Readings

Buford JA, Bedeian AG & Lindner JR. 1995. *Management in Extension*. Ohio State Univ., USA.

Dwivedi RS. 1979. *Human Relations and Organizational Behaviour – A Global Perspective*. 5th Ed. McMillan India.

Keith D. 2004. *Human Behaviour*. 8th Ed. Mc Graw Hill.

Lynton R & Pareek U. 1990. *Training for Development*. Vistar Publ.

Lynton R & Pareek U. 2000. *Training for Organizational Transformation*. Sage Publ.

- Mishra DC. 1990. *New Directions in Extension Training*. Directorate of Extension, Ministry of Agriculture, Govt. of India, New Delhi.
- Stoner JAF & Freeman RF. 1994. *Management*. 5th Ed. Prentice Hall.
- Turban E & Meredith J. 1991. *Fundamentals of Management Science*. 5th Ed. Home Wood I.L. Irwin.
- Weirich H & Koontz H. 1993. *Management – A Global Perspective*. McGraw-Hill.

AHE 611 GENDER AND LIVESTOCK DEVELOPMENT

1+ 0

Objective

To acquaint the students with the concept of gender, its importance in livestock development, livestock development policies and programmes of the government to empower women.

Theory

UNIT I

Basic concepts - gender, empowerment and livestock. Role of livestock sector in Indian economy and poverty alleviation. Enterprise integration- women in agriculture and livestock. Livestock and agrarian scenario – trends in numbers, growth, composition and exports and imports.

UNIT II

Policies and programmes in livestock for empowering women, Composition of livestock sector- dairying and poultry sector, Women entrepreneurship in livestock, Institutional structure in livestock production, processing and marketing- co-operatives, contract farming and SHGs, Case studies- success and failures- from the state, country and other countries.

UNIT III

Globalization and livestock development – opportunities and challenges, WTO- need for quality standards in livestock production- assurance and safety measures- SWOT analysis, Extension techniques for livestock development, Group project work- livestock feasibility report/live-in situation report.

Suggested readings

- Bura N, Deshmukh J, Ranadive & Murthy KR. (Ed). 2006. *Micro Credit, Poverty and Empowerment – Linking the Triad*. Sage Publ.
- NABARD. 2005. *SHG Bank Linkage Programme*. [http:// www.nabard.org](http://www.nabard.org)
- Ramkumar S, Garforth C, Rao SVN & Waldie K. (Ed). 2001. *Landless Livestock Farming – Problems and Prospects*. RAGACOVAS, Pondicherry.
- Seth Mira 2001. *Women and Development – Indian Experience*. Sage Publ.
- Samanta RK. (Ed). *Women in Agriculture – Perspectives, Issues and Experiences*. MD Publ.
- Waldie K & Ramkumar S. 2002. *Landless Women and Dairying – Opportunities for Development within a Poverty Perspective*. RAGACOVAS, Pondicherry.

Objective

To apprise the students about information system, networking and use of various ICT tools.

TheoryUNIT I

ICT – concept, importance and types of tools; Development and application of ICT tools including information kiosks, E-learning

UNIT II

Concept of information system and networking, component of information system, information resources, sharing and networking. Types of net work – PAN, LAN, WAN, Internet, AGRINET, AKIS, Indian National Agricultural Research database.

UNIT III

ICT programmes in livestock development, Problems and prospects of ICTs in livestock development, Digitisation, Simulation models.

Practical

Study of various ICT tools in livestock development.

Suggested Readings

Anonymous 2002. *Handbook of Animal Husbandry*. ICAR.

Arnon I. 1989. *Agriculture Research and Technology Transfer*. Elsevier Science Publ. England.

Ramkumar S & Rao SVN. 2004. *Knowledge Dissemination on Cattle Health through Information Kiosks in Veterinary Centres*. RAGACOVAS, Pondicherry.

Singhal A & Rogers EM. 1989. *India's Information Revolution*. Sage Publ.

Suggested Broad Topics for Master's Research

- * Veterinary Education
- * Training
- * Communication and development
- * Diffusion and adoption
- * Management and entrepreneurship
- * Livestock economics
- * Evaluation of animal husbandry programmes

COMPULSORY NON-CREDIT COURSES

(Compulsory for Master's programme in all disciplines; Optional for Ph.D. scholars)

CODE	COURSE TITLE	CREDITS
PGS 501	LIBRARY AND INFORMATION SERVICES	0+1
PGS 502	TECHNICAL WRITING AND COMMUNICATIONS SKILLS	0+1
PGS 503	INTELLECTUAL PROPERTY AND ITS	1+0
(e-Course) PGS 506	MANAGEMENT	1+0
(e-Course)	DISASTER MANAGEMENT	1+0

Course Contents

PGS 501 LIBRARY AND INFORMATION SERVICES 0+1

Objective

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

Practical

Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-resources access methods.

PGS 502 TECHNICAL WRITING AND COMMUNICATIONS SKILLS 0+1

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc.

To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical

Technical Writing - Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

Communication Skills - Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.

Suggested Readings

- Chicago Manual of Style*. 14th Ed. 1996. Prentice Hall of India.
Collins' Cobuild English Dictionary. 1995. Harper Collins.
Gordon HM & Walter JA. 1970. *Technical Writing*. 3rd Ed. Holt, Rinehart & Winston.
Hornby AS. 2000. *Comp. Oxford Advanced Learner's Dictionary of Current English*. 6th Ed. Oxford University Press.
James HS. 1994. *Handbook for Technical Writing*. NTC Business Books.
Joseph G. 2000. *MLA Handbook for Writers of Research Papers*. 5th Ed. Affiliated East-West Press.
Mohan K. 2005. *Speaking English Effectively*. MacMillan India.
Richard WS. 1969. *Technical Writing*. Barnes & Noble.
Robert C. (Ed.). 2005. *Spoken English: Flourish Your Language*. Abhishek.
Sethi J & Dhamija PV. 2004. *Course in Phonetics and Spoken English*. 2nd Ed. Prentice Hall of India.
Wren PC & Martin H. 2006. *High School English Grammar and Composition*. S. Chand & Co.

PGS 503
(e-Course)

**INTELLECTUAL PROPERTY AND ITS
MANAGEMENT**

1+0

Objective

The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Theory

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of animal varieties and farmers' rights and bio-diversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

Suggested Readings

- Erbisch FH & Maredia K. 1998. *Intellectual Property Rights in Agricultural Biotechnology*. CABI.
Ganguli P. 2001. *Intellectual Property Rights: Unleashing Knowledge Economy*. McGraw-Hill.

Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC & Aesthetic Technologies.

Ministry of Agriculture, Government of India. 2004. *State of Indian Farmer*. Vol. V. *Technology Generation and IPR Issues*. Academic Foundation.

Rothschild M & Scott N. (Ed.). 2003. *Intellectual Property Rights in Animal Breeding and Genetics*. CABI.

Saha R. (Ed.). 2006. *Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies*. Daya Publ. House.

The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.

PGS 506 DISASTER MANAGEMENT 1+0 (e-Course)

Objectives

To introduce learners to the key concepts and practices of natural disaster management; to equip them to conduct thorough assessment of hazards, and risks vulnerability; and capacity building.

Theory

UNIT I

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depletion

UNIT II

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, Industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

UNIT III

Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.

Suggested Readings

Gupta HK. 2003. *Disaster Management*. Indian National Science Academy. Orient Blackswan.

Hodgkinson PE & Stewart M. 1991. *Coping with Catastrophe: A Handbook of Disaster Management*. Routledge.

Sharma VK. 2001. *Disaster Management*. National Centre for Disaster Management, India.

Annexure

PONDICHERRY UNIVERSITY
PUDUCHERRY- 605 014

College: Rajiv Gandhi Institute of Veterinary Education and Research, Puducherry-9

CERTIFICATE OF COMPREHENSIVE/VIVA-VOCE EXAMINATION

This is to certify that Dr.
Reg.No.....of the Department of
appeared for comprehensive examination and Viva-Voce examination held on
..... The performance of the candidate is found to be
.....(to be written by hand 'SATISFACTORY' or 'UNSATISFACTORY'
whichever is applicable)

Marks Obtained in comprehensive examination is _____(marks in percentage)

(Signature)
Name
Major Advisor

(Signature)
Name
External Examiner

(Signature)
Name
(Advisor)

(Signature).
Name
(Advisor)

(Signature)
Name
(Advisor)

(Signature).
Name
(Advisor)

Place:

Date:

Forwarded (in duplicate) to the Dean,

(Signature)
Head of the Department
of.....

Rajiv Gandhi Institute of Veterinary Education and Research, Puducherry-9

CONSTITUTION OF ADVISORY COMMITTEE AND APPROVAL

1. Name of the Student :
2. Reg. No. :
3. Department :
4. Degree :
5. Date of Joining :
6. Major Field :
7. Minor Fields :
8. Proposed Research Problem : (*Broad area of research*)
9. Degrees Earned :

Degree	University / College	Year	% of Marks / OGPA

Whether the prescribed core courses included? YES/NO

(Details of course work done enclosed – Form 2(a))

Advisory Committee Proposed

Sl.No.	Name & Designation	Status	Signature
		Chairman	
		Member	
		Member	
		Member	

Recommended

Chairman, Advisory Committee

Date:

Approved

Dean

Date:

**PONDICHERRY UNIVERSITY
PUDUCHERRY– 605 014**

College: Rajiv Gandhi Institute of Veterinary Education and Research, Puducherry-9

Submission of Thesis for M.V.Sc Degree

1. Subject :
2. Name of the Student :
3. Reg. No. :
4. Academic year of Admission :
5. Date of Admission :
6. Date of thesis submission in the
department :
7. Title of the thesis :
8. State whether the thesis is as per the
approved outline of Research work :
9. Whether details of courses completed
in major & minor fields enclosed :

(Copy of the transcripts to be enclosed)

10. Certified that the thesis is the result of original work carried out.

Signature of the Student

**Name & Signature of the Chairman
Advisory Committee**

Submitted to the Dean

Signature of the Head of the Department

Encl.:

1. Three copies of Thesis
2. Approved ORW
3. 'No dues' certificate
4. Thesis fee receipt

**PONDICHERRY UNIVERSITY
PUDUCHERRY – 605 014**

College: Rajiv Gandhi Institute of Veterinary Education and Research, Puducherry-9

Thesis Evaluation Report

Name of student	
Admission No.	
Degree sought	
Discipline	
Thesis Title	
1. Technical Comments	
A. Significance of research problem	
B. Abstract	
C. Research Techniques & Methodology:	
D. Results and their interpretation:	
E. Summary and Conclusions	
F. Review of literature	
2. Presentation of data	
A. Clarity of expression:	
B. Tabulation	
C. Quality of illustrations	
3. Language, Grammar and Spelling mistakes etc.	
Correctness	
Punctuation etc.	
Bibliography	
Suggested improvements, if any	
4. Contribution made in the relevant discipline	
5. Recommendations :	Highly Commended/Commended/Revise and Resubmit /Rejected (Strike out whichever is not applicable)

Signature of Examiner

Name and Address

**PONDICHERRY UNIVERSITY
PUDUCHERRY – 605 014**

College: Rajiv Gandhi Institute of Veterinary Education and Research, Puducherry-9

Report of MVSc Thesis and Viva-Voce Examination

Name of the Student:

Reg.No.

Degree:

Subject:

Date of Viva-Voce Examination:

Title of the thesis:

The external examiner and members of the Advisory committee hereby certify that we had examined the evaluation report of the above thesis and conducted Viva-Voce examination. In the judgment of the examining body, the performance of the candidate is _____ (To be written by hand 'SATISFACTORY' or 'UNSATISFACTORY' whichever is applicable) AND the thesis is _____ (to be written by hand ACCEPTED or NOT ACCEPTED) for the award of MVSc Degree

Chairman:	Name	Signature
External Examiner:	Name	Signature
Member:	Name	Signature
Member:	Name	Signature
Member:	Name	Signature

Forwarded (in duplicate) to the Dean, RIVER for onward transmission to the University.

Head of the Department

Format of ORW and Thesis

Format of Outline of Research Work (Guidelines)

<Title>



Outline of Research Work

for

M.V.Sc. Degree

in

<subject>

Submitted by

<Name of the Student>

<Registration Number>

To

*Rajiv Gandhi Institute of Veterinary Education and Research,
Kurumbapet, Puducherry – 605 009*

<year>

Outline of Research Work for M.V.Sc Degree

1. Name of the Student :
2. Reg. No. :
3. Department :
4. Degree :
5. Date of Joining :
6. Major Field :
7. Minor Fields :
8. Title of the thesis :
9. Objectives :
10. Review of Literature :
11. Plan of Research Work
including Methodology :
12. Facilities required & their availability :

(Signature of the student)

Date:

Advisory Committee

Sl.No.	Name	Status	Signature
		Chairman	
		Member	
		Member	
		Member	

Certified that the ORW of the student has been formulated and finalized in accordance with the laid down procedures.

Signature of the Head of the Department

Date:

ARROVED / NOT APPROVED

Signature of the Dean

FORMAT OF THE THESIS *(Guidelines)*

The thesis should be prepared with the following contents:

1. Cover page - *Page 1 of thesis format*
2. Inside Cover - *Page 1 of thesis format*
3. Certificates - *Page 2 & 3 of thesis format*
4. Dedication, if any
5. Acknowledgements
6. List of Abbreviations
7. Abstract - *Page 4 of thesis format*

INDEX (Indicate the starting and ending page of each section, eg. 9-17)

8. *Introduction (including Objectives)
 9. *Review of Literature
 10. *Materials and Methods
 11. *Results and Discussion (either combined or separately)
 12. *Summary and Conclusion
 13. *Appendices (Optional) – Additional data (tables / figures etc.,) in support of the results, if required
 14. *Bibliography - *Page 5 of thesis format*
-

* Before beginning of each of the above topics, a separate sheet with heading printed in bold letters should be inserted.

- The thesis should be typed in A4 size paper in MS word format using New Times Roman font with letter size 12 on the one side of the paper
- 1.5” margin on left side and 1” margin on right side should be given
- The space between the lines should be 1.5
- The thesis should be soft bound

<Title of the Thesis>

Thesis

Submitted in partial fulfillment of
the requirements for the award of the degree of

Master of Veterinary Science
in
<Subject>

To
Pondicherry University

by

Dr. *. *****
(Reg. No. #####)



Department of xxxxxx

RAJIV GANDHI INSTITUTE OF VETERINARY EDUCATION AND RESEARCH

Puducherry – 605 009

<Month> <Year>

**RAJIV GANDHI INSTITUTE OF VETERINARY EDUCATION AND RESEARCH
Puducherry – 605 009**



**Dr. xxxxxx
Designation
Department**

Date: _____

CERTIFICATE

This is to certify that the thesis entitled “xxxxxxxxxxxxxxxxxxxxxxxxxxxxx” submitted by Dr. xxxxxx in partial fulfillment of the requirements for the award of degree of **MASTER OF VETERINARY SCIENCE** (subject) of the Pondicherry University is a bonafide research work carried out under my guidance and supervision and no part of the thesis has been submitted for the award of any other degree or diploma.

(Name)
Major Advisor & Chairman

<***Title of Thesis***>

Thesis Submitted to
Pondicherry University, Puducherry
in partial fulfillment of the requirements for the
award of the degree of

Master of Veterinary Science
in
<*Subject*>

by

Dr. *. *****
(Reg. No. #####)

APPROVED

External Examiner
(Signature & Name)

Major Advisor & Chairman
(Signature & Name)

Members, Advisory Committee

1. Name, Designation & Address
(Signature)

2. Name, Designation & Address
(Signature)

3. Name, Designation & Address
(Signature)

ABSTRACT (not more than 300 words)

1. Name of the Candidate :
2. Reg. No. :
3. College :
4. University :
5. Degree :
6. Major Field :
7. Year of submission :
8. Title of the thesis :
9. Name of the Supervisor :

(Type the content of the abstract in single line spacing)

BIBLIOGRAPHY

The references are to be arranged according to the alphabetical order of the first author's name in the following format.

Gillespie BE and Oliver SP (2005) Simultaneous detection of mastitis pathogens, *Staphylococcus aureus*, *Staphylococcus uberis*, and *Streptococcus agalactiae* by multiplex real – time polymerase chain reaction. *J. Dairy Science*, 88: 3510-3518.

Gillespie BE and Oliver SP (2005) Simultaneous detection of mastitis pathogens, *Staphylococcus aureus*, *Staphylococcus uberis*, and *Streptococcus agalactiae* by multiplex real – time polymerase chain reaction. *J. Dairy Science*, 88: 3510-3518.

Use 1.0 space within the reference and 1.5 space between the references