College of Veterinary & Animal Sciences

Course Curriculum

M.V.Sc Degree Programme

(As per Indian Council of Agricultural Research Recommendations)

2019

Sardar Vallabhbhai Patel University of Agriculture & Technology,
Meerut-250110 (U.P.)

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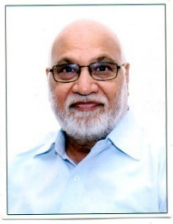

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Foreward

I am glad to know that college of Veterinary and Animal Sciences is publishing the course catalogue for Masters programme on different subjects as prescribed by Indian Council of Agricultural Research (ICAR). It is comprehensive course curricula of different departments for Masters in Veterinary Science degree programme. The booklet provides the details of department-wise courses including course title, course number, credit hours etc. The course content of each subject comprises of detailed description of various courses to be offered for Master's students. Each course contains objective, detail description of topics for theory as well as practical. Some of the suggestive readings given at the end of each course can be used as a reference by the students and teachers.

I hope the syllabi booklet containing comprehensive course curricula of various subjects of Veterinary and Animal Sciences will be immensely useful to the post graduate students of the college. I appreciate the efforts of the faculty of the college to bring out the course catalogue for the Master's programme.

G Prasad

(Gaya Prasad)

Registrar
Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut-250110

Message

I am very happy to share with you that College of Veterinary and Animal Sciences is publishing the syllabi booklet based on the Indian Council of Agricultural Research recommended syllabus for Master's degree programme in veterinary science. It is high time to strengthen the syllabi and curricula for master's degree programme because M.V.Sc is a specialized degree and students suppose to be expert in a particular field. The booklet will be of immense value for the students, teachers and academicians because of the readymade information on course curriculum. The content on various departments may be helpful in planning the teaching, research and extension activities in a particular filed of specialization. The planning can be done in advance to decide the field of specialization and area to be exploited for research in that particular field. Thorough knowledge of subjects and practical hands on training can further assure employability and entrepreneurial skills in students.

I expect that the course curriculum and syllabi booklet is being published by the College of Veterinary and Animal Sciences will be quite useful to the students and faculty members of various disciplines of the college. I congratulate Dr Rajbir Singh and entire College of Veterinary and Animal Sciences team for preparing and publishing the syllabi booklet.

(Ashok Kumar)

Dean
Post Graduate Studies
Sardar Vallabhbhai Patel University of
Agriculture & Technology, Meerut-
250110

Message

Agriculture including livestock sector is the backbone of Indian economy since ancient civilization. In India, there is a vast potential in animal husbandry sector. Only is the need to reorganize, sustain, support and promote the livestock farmers. But changes in trade policies, increased globalization, climate change and reduction in land holdings due to rapid urbanization and industrialization, have imposed newer challenges to animal husbandry sector. These challenges are to be addressed by coordinated efforts of the government, academicians, researchers and stakeholders. The generation of human resource to overcome these challenges in livestock sector is the prime responsibility of agricultural universities. In this context, a comprehensive and specialized need based course curriculum as prescribed by the Indian Council of Agricultural Research for Master's degree programmes is adopted in the university with the need based modifications in various disciplines.

I am sure that the syllabi booklet consisting of vast course content of various departments of College of Veterinary and Animal Sciences for M.V.Sc degree programme will serve the purpose of quality education in the university. I congratulate Dr Rajbir Singh and team for compilation of comprehensive course curricula for the Master's degree programme.

(N.S. Rana)

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Course syllabus for Master of Veterinary Science in different departments of College of Veterinary and Animal Sciences

Livestock plays an important role in Indian economy. About 20.5 million people depend upon livestock for their livelihood. Livestock contributed 16% to the income of small farm households as against an average of 14% for all rural households. Livestock sector contributes 4.11% GDP and 25.6% of total Agriculture GDP. Livestock rearing practices have dramatically changed in recent years from subsistence to commercial, subsidiary to main-occupational and unorganized to intensively organized systems. These achievements have taken place in spite of the limited priority and monetary allocations to this sector and the poor resources of the majority of the farmers who have contributed to this phenomenal transition. The high quality man power generated through the educational institutions dealing with veterinary and animal sciences has been mainly instrumental in fulfilling the technological backstopping needed at the field level, through scientific research and technology development.

The farming community and the industry adopted latest innovations in production, processing, health and management, resulting in production and productivity enhancement and increased per capita availability of livestock products. Today, India leads the world in milk production with around 100 million tonnes per annum. Over seventy per cent of the milk produced in India is contributed by semi-medium, small, marginal and landless farmers. Another significant feature of milk production is that over 56 per cent of it is derived from the buffalo, which is an animal species of pride to this country. Poultry sector has set the trend for other sub-sectors of livestock rearing by its intensive commercialization, high productivity level and technology adoption of a high order. Concerns of food and nutritional security are being adequately addressed through inclusion of food products of animal origin in the human diet, particularly the vulnerable sections of the society such as growing children, adolescents, pregnant and nursing mothers, senior citizens and convalescing patients.

Keeping in view of contribution of livestock and veterinary sector in Indian economy various institutions started Graduation, Master's and Doctoral programmes. These programmes are essential to cater the demand of future veterinarians and to develop human resource in allied fields. College of Veterinary and Animal Sciences, SVPUAT, Meerut was established on the same mandate.

1. **Course Programmes**: Master of Veterinary Science (M.V.Sc) in following departments:
   a) Veterinary Anatomy
   b) Veterinary Pharmacology & Toxicology
   c) Veterinary Public Health & Epidemiology
   d) Animal Nutrition
   e) Livestock Products Technology
   f) Veterinary Gynaecology & Obstetrics
   g) Veterinary Surgery & Radiology
   h) Veterinary Medicine
   i) Veterinary & Animal Husbandry Extension Education
   j) Veterinary Microbiology
   k) Veterinary Pathology
   l) Veterinary Biochemistry
   m) Veterinary Physiology
   n) Animal Genetics & Breeding
   o) Livestock Production & Management
   p) Veterinary Parasitology

2. **Eligibility Criteria for Admission**: For admission in Master of Veterinary Science (M.V.Sc), the eligibility criteria shall be B.V.Sc & A.H./B.V.Sc degree and registration in Veterinary Council of India or State Veterinary Council.
3. **Number of seats**: 04 in each of the department.
4. **Credit Requirements: Common academic regulation of Indian Council of Agricultural Research (ICAR) will be followed.**

The total course work of 40 credit hours is proposed at M.V.Sc. level with 20 research credit hours. The breakup of the course work: Major subject (including 1 credit seminar) – 29 credits, minor subject (specified in table 1) and supporting subjects (as per requirement) together -11 credits.

Out of 11 credit hours for minor and supporting subjects, courses with a minimum of 6 credits should be taken from minor subject and course(s) with a minimum of 3 credit hours from supporting subject(s) should be taken. Thus students will have the option to register courses of 6 to 8 credit hours in minor subject and of 3 to 5 credits in supporting subject.

Four compulsory non-credit courses among the courses namely, Library and Information Services (0+1), Technical Writing and Communication Skills (0+1), Intellectual Property and its Management (1+0) and Disaster Management (1+0), Basic Concepts in Laboratory Techniques (0+1), Agriculture research, Research Ethics and Rural development Programmes are mandatory at Master's level.

Some of the deficiency courses may also be taken by the students depending on the need and recommendations of advisory committee. These course may be taken by students among the courses existed in university.

Minimum Credit Requirements

Subject	**Master's Programme (M.V.Sc)**
Major Courses	28+01=29
Minor Courses*	6 -8
Basic Supporting Courses*	3-5
Deficiency Courses	As per the need of student
Non Credit Course	04
Master's Research	20
Total credits (Minimum)	60

*Minimum 6 for minor and 3 for supporting

Note: Details of the courses i.e. title, number, credit hours etc. are given department wise hereinafter. Syllabus and guidelines as suggested by Indian Council of Agricultural Research (ICAR) have been observed and adopted. Changes wherever required have also been made and such changes are being specifically mentioned.

Department of Veterinary Anatomy

A. Major – Subject Veterinary Anatomy (Minimum -29 Credit Hours)

S.No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1	Comparative osteology and arthrology	VAN 601	3 (1+2)
2	Comparative splanchnology	VAN 602	4 (2+2)
3	Gross anatomical techniques	VAN 604	2 (0+2)
4	Theory and practice of histological and histochemical techniques	VAN 605	3 (1+2)
5	General histology and ultrastructure	VAN 606	4 (3+1)
6	Developmental anatomy	VAN 608	4 (3+1)
	Master's seminar	VAN 691	1 (1+0)
Optional Courses			
1	Myology, angiology, neurology and aesthesiology of ox	VAN 603	4 (1+3)
2	Systemic histology and ultrastructure	VAN 607	4 (3+1)
3	Avian Anatomy	VAN 609	3 (1+2)

B. Minor (Minimum 6-8 Credit Hours)

a. Prescribed Minor Subjects

Veterinary Physiology, Veterinary Pathology, Veterinary Biochemistry Veterinary Surgery & Radiology

b. List of Courses for Minor in Department of Veterinary Anatomy

S.No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1	Comparative osteology and arthrology	VAN 601	3 (1+2)
Optional Courses			
1	Myology, angiology, neurology and aesthesiology of ox	VAN 603	4 (1+3)
2	Theory and practice of histological and histochemical techniques	VAN 605	3 (1+2)
3	General histology and ultrastructure	VAN 606	4 (3+1)
4	Systemic histology and ultrastructure	VAN 607	4 (3+1)
5	Avian Anatomy	VAN 609	3 (1+2)
6	Gross anatomical techniques	VAN 604	2 (0+2)

C. Basic Supporting Courses (Minimum 3-5 Credit Hours)

S.No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1.	Experimental Design	STAT 512	3 (2+1)
Optional Courses			
The optional supporting course can be taken from the minor or other subject according to need of Master's research.			

D. Deficiency Courses (As per the need of student on the recommendation of advisory Committee)

S.No.	*Course Title*	*Code*	*Credit Hrs*
Student can opt any course from the courses offered in university.			

E. Non Credit Compulsory Courses (Any four courses, minimum of 4 Credit Hrs)

S.No.	*Course Title*	*Code*	*Credit Hrs*

1	Library and Information Services	PGS 501	1(0+1)
2	Technical writing and communications skills	PGS 502	1(0+1)
3	Intellectual Property and its management	PGS 503	1(1+0)
4	Basic Concepts in Laboratory Techniques	PGS 504	1(0+1)
5	Agriculture research, Research Ethics and Rural development Programmes	PGS 505	1(1+0)
6	Disaster management	PGS 506	1(1+0)

F. *Master's Thesis Research*

S.No.	*Course Title*	*Code*	*Credit Hrs*	*Remark*
1.	Master's Research	VAN 699	20 (0+20)	On the recommendation of advisory committee

Credit Hours = 29+11+20 = 60

VETERINARY ANATOMY AND HISTOLOGY

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, mammectomy, 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.

Uni 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 Histological and Histochemical Techniques 1+2

*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 light and ultrastructure of four basic tissues.

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.

VAN 609 Avian Anatomy 1+2

Objective:

Theory

Unit I: The study of the gross features of different body systems (skeletal, muscular, nervous, digestive, respiratory, urinary and reproductive systems) of domestic fowl

Unit II:The study of microscopic features of different body systems (skeletal, muscular, nervous, digestive, respiratory, urinary and reproductive systems) of domestic fowl.

Practical

Dissection and demonstration of various body systems of fowl and different domestic birds. Microscopic examination of slides of various organ systems of fowl.

Suggested Readings

Veterinary Public Health & Epidemiology

A. Major: Veterinary Public Health & Epidemiology (Minimum: 29 Credits Hours)

S.No.	*Course Title*	*Code*	*Credit Hr*
Core Courses			
1	Elements of Veterinary Public Health	VPE 601	2 (1+1)
2	Zoonoses and Public Health	VPE 604	3 (2+1)
3	Principles of Food Hygiene and Safety	VPE 605	4 (3+1)
4	Meat and Milk Hygiene	VPE 606	3 (2+1)
5	Environmental Pollution and Safety	VPE 607	3 (2+1)
6	Principles of Epidemiology	VPE 610	2 (2+0)
7	Master's Seminar	VPE691	1 (1+0)
Optional courses			
1	Bacterial and Rickettsial Agents of Public Health Significance	VPE 602	3 (2+1)
2	Viral, Fungal and Parasitic Agents of Public Health Significance	VPE 603	3 (2+1)
3	Fish, Fish Products and Seafood Hygiene	VPE 608	2 (1+1)
4	Bioterrorism and Disaster Management	VPE 609	2 (1+1)
5	Applied Epidemiology	VPE 611	2 (1+1)
6	Livestock and Poultry Disease Investigation	VPE 612	2 (0+2)

B. Minor (Minimum 6-8 Credit Hours)

a. Prescribed Minor Subjects

Veterinary Microbiology, Veterinary Pharmacology & Toxicology, Veterinary Parasitology, Veterinary Pathology, Animal Biotechnology, Livestock Products Technology

b. Core Courses		
1.	VPE 604 Zoonoses and Public Health	2+1
c. *Other courses offered by the Department will be opted as per need of student and on the recommendation of advisory committee*		

C. Basic Supporting Courses (3-5 Credit Hours)		
a. Compulsory		
SAT 512	Experimental Design or any other statistical course as per need	2+1
b. Optional courses		
	Will be selected as per the research problem and recommendation of advisory committee	

D. Deficiency Courses (As per need of the student on the recommendation of advisory committee)
Student may opt any courses offered at University

E. Non Credit Compulsory Courses (Any four courses)		
PGS 501	Library and Information Services	0+1
PGS 502	Technical writing and communications skills	0+1
PGS 503	Intellectual Property and its management	1+0
PGS 504	Basic Concepts in Laboratory Techniques	0+1
PGS 505	Agriculture Research, Research Ethics and Rural development Programmes	1+0
PGS 506	Disaster management	1+0

F. Thesis Research		
VPE 699	Master's Research	0+20

Credit Hours = 29+11+20=60

VPE 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.

VPE 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.

T*heory*

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.

VPE 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.

VPE 604 Zoonoses 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.
Unit II: Bacterial diseases: anthrax, brucellosis, tuberculosis, salmonellosis, yersiniosis, leptospirosis, listeriosis, plague, tularaemia, glanders, malioidosis, 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, tickborne 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.
Suggested Readings
Thapliyal DC. 1999. *Diseases of Animals Transmissible to Man*.
International Book Distr. Co.

VPE 605 Principles of Food Hygiene and Safety 3+1
Objective: To acquaint the students about principles of food hygiene, quality improvement practices and major foodborne illnesses.
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: Food-borne bacterial infection and intoxications due to Salmonella, Campylobacter, Clostridium, Staphylococcus, Listeria, Vibrio, E. coli, Bacillus cereus, bacterial toxins.
Unit IV: Foodborne viral infections: infectious hepatitis, poliomyelitis, gastroenteritis etc, natural toxic substances in foods.
Unit V: Health problems due to food additives, biocides, bacterial toxins. Heavy metals, antibiotics, hormones etc. in food.
Unit VI: Microbiological standards and quality control (biological and other indicators of hygienic quality and spoilage) of foods to prevent food-borne infections.
Unit VII: 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. Detection and quantificatiopn of food-borne pathogens, toxins, antibiotics, pesticides and additives in foods.
Suggested Readings
Jay JM. 1996. *Modern Food Microbiology*. CBS.

VPE 606 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.

VPE 607 Environmental Pollution and Safety 2+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 pesticide 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.

VPE 608 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.

VPE 609 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, tsunami 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. Bioethics 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.

VPE 610 Principles of Epidemiology **2+0**

Objective: To familiarize students with epidemiological concepts.

Theory

Unit I: Definitions, scope, concepts, types, application and common terms in epidemiology.

Unit II: Host-Agent- Environmental factors in causation of disease and disease patterns.

Unit III: Epidemiological data: its nature, sources, collection, storage, retrieval and presentation. Unit IV: Epidemiological studies: Experimental and observational, international organizations and laws regulating animal diseases.

Suggested Readings

Martin SW, Meek AH & Willeberg P. 1993. *Veterinary Epidemiology:Principles and Methods*. IBH.

Narayan KG. 2004. *Epidemiology, Diagnosis and Management of Zoonoses*. ICAR.

Schwabe CW, Riemann HP & Franti CE. 1984. *Epidemiology in Veterinary Practice*. 3rd Ed. Lea & Fabiger.

Thrusfield M. 2004. *Veterinary Epidemiology*. 8th Ed. Blackwell.

VPE 611 Applied Epidemiology **1+1**

Objective: To acquaint students with the application of epidemiology in disease diagnosis, prevention and control

Theory

Unit I: Surveys, sampling and collection of information, design questionnaires, disease monitoring and surveillance.

Unit II: Epidemiological investigations of disease outbreak, modeling, disease forecasting, serological and molecular epidemiology.

Unit III: Economics of diseases and different strategies for prevention and control of diseases and syndromes. Disease free zones and zero disease concept.

Unit IV: Molecular basis of a disease, application of nucleic based assays for genomic characterization of field isolates vis-a-vis vaccine strains.

Practical

Design Proforma questionnaires for collection of information on health and disease in populations, sero-surveys for important disease of livestock and poultry, investigation of outbreaks, use of computer software in epidemiology

Suggested Readings

Martin SW, Meek AH & Willeberg P. 1993. *Veterinary Epidemiology*: Principles and Methods. IBH.

Thrusfield M. 2004. *Veterinary Epidemiology*. 8th Ed. Blackwell.

Thomas B. (Ed.). *Applied Veterinary Epidemiology*. Elsevier.

VPE 612 Livestock and Poultry Disease Investigation **0+2**

Objective: To expose students to actual field based investigations of diseases in livestock and poultry

Practical

To attend outbreaks of infectious diseases and toxicological conditions in livestock and poultry in the field and at farms. Recording and analysis of data. Investigation and diagnosis on dead and live diseased animal (s) and poultry. Collection, Preservation and transport of material in the face of disease outbreak, and processing of material in the laboratory for diagnosis; screening of animal herds and poultry flocks for certain important disease. Formulating and advising treatment and control measures. Extractions and isolation of nucleic acid of field isolates and vaccine strains, and their characterization by PCR and other techniques.

Suggested Readings

Vihan VS. 2002. *Modern Veterinary Laboratory Techniques in Clinical Diagnosis*. CBS.

VETERINARY PHARMACOLOGY & TOXICOLOGY

A. Major –Subject Veterinary Pharmacology & Toxicology (Minimum -29 Credit Hours)

S.No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1.	General Pharmacology	VPT-601	2 (2+0)
2.	Autonomic and Autacoid Pharmacology	VPT-602	3 (2+1)
3.	CNS Pharmacology	VPT-603	3 (2+1)
4.	Digestive and Respiratory Pharmacology	VPT-604	2 (2+0)
5.	Cardiovascular and Renal Pharmacology	VPT-605	2 (2+0)
6.	Endocrine and Reproductive Pharmacology	VPT-606	2 (2+0)
7.	Chemotherapy	VPT-607	3 (2+1)
8.	Toxicology of Xenobiotics	VPT-608	3 (2+1)
9.	Toxicology of Plants And Toxins	VPT 609	2 (2+0)
10.	Pharmacological Techniques	VPT-610	2 (1+1)
11.	Techniques in Toxicology	VPT-611	2 (1+1)
12.	Ethnopharmacology	VPT-612	2 (2+0)
13.	Master's Seminar	VPT-691	1 (1+0)
Optional Courses			
1	Production Pharmacology	VPT-613	2(2+0)
2	Drug Regulatory Affairs And Intellectual Property Rights	VPT-614	2(2+0)
3	Target Organ Toxicity	VPT-615	2(2+0)
4	Pharmcogenomics (To be taught jointly with Veterinary Physiology & Biochemistry)	VPT/VPB-616	2(2+0)
5	Pharmacoinformatic (To be taught jointly with Veterinary Physiology & Biochemistry)	VPT/VPB-617	2(2+0)

B. Minor (Minimum 6-8 Credit Hours)

a. Prescribed Minor Subjects

Veterinary Physiology, Veterinary Biochemistry, Veterinary Clinical Medicine, Ethics & Jurisprudence, Veterinary Pathology

b. List of Courses for Minor in Department of Veterinary Pharmacology & Toxicology.

S.No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1	Chemotherapy	VPT-607	2+1=3
2	Toxicology of Xenobiotics	VPT-608	(2+1) 3
Optional Courses			
1	General Pharmacology	VPT-601	(2+0) 2
2	CNS Pharmacology	VPT-603	2+1=3
3	Pharmacological Techniques	VPT-610	1+1=2
4	Techniques In Toxicology	VPT-611	1+1=2

C. Basic Supporting Courses (Minimum 3-5 Credit Hours)

S.No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1.	Experimental Design	STAT-512	3 (2+1)
Optional Courses			
	Will be selected as per the research problem and recommendation of advisory committee		

D. Deficiency Courses (As per the need of student on the recommendation of advisory committee)

S.No.	*Course Title*	*Code*	*Credit Hrs*
Student can opt any course from the courses offering in university.			

E. Non Credit Compulsory Courses (Any four courses, minimum of 4 Credit Hrs)

S.No.	*Course Title*	*Code*	*Credit Hrs*
1.	Library and Information Services	PGS 501	1(0+1)
2.	Technical writing and communications skills	PGS 502	1(0+1)
3.	Intellectual Property and its management	PGS 503	1(1+0)
4.	Basic Concepts in Laboratory Techniques	PGS 504	1(0+1)
5.	Agriculture research, Research Ethics and Rural development Programmes	PGS 505	1(1+0)
6.	Disaster management	PGS 506	1(1+0)

F. Master's Thesis Research

S.No.	*Course Title*	*Code*	*Credit Hrs*
1.	Master's Research	VPT-699	20 (0+20)

Total Credit Hours=29+11+20 =60

VETERINARY PHARMACOLOGY AND TOXICOLOGY

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, polymixins, 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, pAx, pDx and pD'x values. Specific tests for evaluation of tranquillizing, hypnotic, analgesic, anticonvulsant, general and local anesthetic, muscle relaxant, antiinflammatory, 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, mutagencity, 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. Mannfred 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.

VPT-613 Production Pharmacology 2+0

Objective: To impart the knowledge regarding sources of medicinal components of various drugs.

Theory

Unit I: Introduction, growth promoters including- antimicrobials, ionophores, hormones, repartitioning agents and probiotics.

Unit II: Neutraceuticals in animal production. Possible consumer concerns of growth promoting agents.

Unit III: Drug and food interactions, Gene therapy.

Unit IV: Drugs used in synchronization of oestrus and induction of superovulation.

Unit V: Role of biotechnology in Pharmacology. Bio-technology-derived therapeutic agents.

Suggestive readings:

Goodman and Gilman's The Pharmacological Basis of Therapeutics, 13th Edition13th Edition
Relevant websites.

VPT-614 Drug Regulatory Affairs &Intellectual Property rights 2+0

Objective: To import knowledge and information on drug regulatory affairs and intellectual property rights

Theory

Unit I: Drug and Cosmetics Acts, rules with special reference to schedule Y & M, Drug Regulatory Affairs. Requirements of cGMP, GLP, GCP, USFDA, IND, NDA & ANDA, BA/BE Studies- USFDA, CDSCO & EUDRA guidelines.

Unit II: Intellectual Property Rights Processing & its application (patents, Trademarks, Copyrights), Patents Act, Major emphasis on Patents related to: Patentable subject matter , Non-Patentable subject matter, Criteria for getting a patent, Types of patent and its usefulness, Filing procedure for patents, Patent cooperation treaty: Introduction & their advantage, Trade related aspect of intellectual property rights: Introduction & their advantage. Environment protection Act & Factory Act.

Unit III: Requirements for factory premises for Medical Devices and In-vitro Diagnostic products in India,Concepts in validation, Analytical & Process validation & ISO 9000 Series Basic concepts of Quality Control & quality assurance systems control of quality variation of Raw materials, containers & closures. In process quality control tests, ICH Guidelines-An introduction of [Q1A (R2), Q3A (R2) & Q6A) guidelines.

Unit IV: Biosimilars: An introduction , Fixed dose combination: USFDA Guideline.

Suggestive readings:

Guarino, R.A., New Drug Approval Process, Informa Healthcare, New York.
Drugs & Cosmetic Acts & rules.
Patents Act.
Factory Act.
Consumer Protection Act.
Environmental Protection Act.
Federal Food, Drug & Cosmetic Act.
Loftus, B.T. & Nash RA Pharmaceutical Process Validation ,Informa Healthcare, New York.
Sharma PP., Validation in Pharmaceutical industry, Vandana publication pvt. Ltd, Delhi.
Nally JD., Good manufacturing practices for Pharmaceuticals, Informa Healthcare, New York.
Garfiedl, Quality Assurance Principles for Analytical Laboratories.
Martin RP. And Berry IR., The Pharmaceutical regulatory process, Informa Healthcare, New York.
Relevant websites.

VPT-615Target organ toxicity 2+0

Objective: To study the toxicological effect of xenobiotics on different systems of animal body

Theory

Unit I: Blood: Toxic effects on hematopoesis, toxicants induced hypoxia and oxidative hemolysis. Unit II: GIT: Role of GIT in elimination of toxicants, sources and effects of gastrointestinal toxicity, interactions between xenobiotics and gastrointestinal flora.

Unit III: Liver: Types of injury, mechanisms and effects of hepatotoxicity.

Unit IV: Kidney: Susceptibility of kidney to toxic damage, common nephrotoxicants and their mode of action, consequences of their exposure.

Unit V: Lung: Airpollutants and other chemicals producing lung injury and their effects.

Unit VI: Reproductive system: Targets, mechanisms of action and effects of reproductive and developmental toxicants.

Unit VII: Skin: Contact and allergic dermatitis, phototoxicity, skin tumors.

Suggestive readings:

Goodman and Gilman's The Pharmacological Basis of Therapeutics, 13th Edition13th Edition

Casarett&Doull's Essentials of Toxicology, Third Edition (Lange)3rd Edition

Relevant websites.

VPT/VPB-616 Pharmacogenomics 2+0

Objective: To impart information on genomics based treatment of various diseases

Theory

Unit I: History, concepts and definitions of Pharmcogenomics, Transcriptomics, Proteomics, Metabolomics.

Unit II: Importance of Pharmacogenetics to variability in drug response.

Unit III: Ethnic diversity, Polymorphism selection. Pharmacogenetic measures, Candidate gene versus genome-wide approaches. Functional studies of polymorphism.

Unit IV: Pharmcogenetic phenotypes, Genetic polymorphism affecting pharmacokinetics, drug targets-receptors, modyfying disease-drug response.

Unit V: Pharmcogenomics and drug development, Pharmcogenomics in clinical practice.

Suggestive readings:

Goodman and Gilman's The Pharmacological Basis of Therapeutics, 13th Edition13th Edition

Lisa B.,Combinational Library Methods and

- Relevant websites.

VPT/VPB-617 Pharmacoinformatics 2+0

Objective: Study of important drug targets and their variations

Theory

Unit I: General Pharmacoinformatics.

Unit II: Drug Design: Study of important drug targets and their variations;Pharmacophore designing; prediction of ADME properties.

Unit III: Computational tool for toxicity prediction; SAR and QSAR techniques in drug designing; Drug receptor interactions, Structure based drug design; Lipinski's rule in drug design.

Unit IV: Chemogenomics, chemoinformatics, Pimmunoinformatics, cancer informatics, neuroinformatics, toxicoinformatics, Tools used in pharmacoinformatics,

Unit V: Case studies and applied pharmacoinformatics.

Suggestive readings:

Gupta,S.P. ,1996. Quantum Biology.New Age.

Malone, P.M., Kier, K.L., Srtanovich, J.E. Drug Information-A Guide for Pharmacists. McGraw-Hill, 2006.

Krishnan Namboori P K and Deepak O M. Computational Drug Design and Delivery systems-principles and applications, Springer. 2012.

GredFolkers, Wolfgang Sippl,DidierRognan& Hans Dieter, 2003,Molecular Modeling: Basic Principles and applications,Science.

Prasad V. Bharatam, Modeling and Informatics in Drug Design, John Wiley & Sons Inc.2007.

Tagelsir Mohamed Gasmelseid, Pharmacoinformatics and Drug Discovery Technologies: Theories and Applications, IGI-Global, 2012

Department of Animal Nutrition

A. Major – Animal Nutrition (Minimum -29 Credit Hours)

S.No.	*Course Title*	*Credit Hrs*	*Code*
Core Courses			
1.	Animal nutrition – energy and protein	ANN 601	3 (3+0)
2.	Animal nutrition – minerals, vitamins and feed additives	ANN 602	4 (3+1)
3.	Feed conservation ,storage and quality control	ANN 604	4 (2+2)
4.	Ruminant nutrition	ANN 605	3 (2+1)
5.	Non-ruminant nutrition	ANN 606	2 (1+1)
6.	Nutrition of companion/laboratory, wild and zoo animals	ANN 607	3 (2+1)
7.	Research techniques in animal nutrition	ANN 608	4 (1+3)
8.	Non conventional feed stuff and Toxic constituents/ antimetabolites in animal feedstuff	ANN 609	3 (2+1)
9.	Master seminar	ANN 691	1 (1+0)
Optional Courses			
1	Feed technology	ANN 603	2 (1+1)
2	General Animal Nutrition	ANN 610	2 (1+1)
3	Special Problems in Animal Nutrition	ANN 611	2 (0+2)

B. Minor (Minimum 6-8 Credit Hours)

a. Prescribed Minor Subjects

Veterinary Physiology, Veterinary Biochemistry, Livestock Production and Management Veterinary Biotechnology, Livestock Product Technology, Poultry Science

b. List of Courses for Minor in Department of Animal Nutrition

S.No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1.	Animal nutrition – energy and protein	ANN 601	3(3+0)
Optional Courses			
2.	Animal nutrition – minerals, vitamins and feed additives	ANN 602	4 (3+1)
3.	Feed conservation ,storage and quality control	ANN 604	4 (2+2)
4.	Ruminant nutrition	ANN 605	3 (2+1)
5.	Non-ruminant nutrition	ANN 606	2 (1+1)

C. Basic Supporting Courses (Minimum 3-5 Credit Hours)

S.No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1.	Experimental Design	STAT-512	3(2+1)
Optional Courses			
It may be taken from prescribed minor subjects or other subjects as per the need of the student and suggestion of advisory committee			

D. Deficiency Courses (As per the need of student on the recommendation of advisory committee)

S.No.	*Course Title*	*Code*	*Credit Hrs*
Student can opt any course from the courses offering in universityas per the need of the student and suggestion of advisory committee			

E. Non Credit Compulsory Courses (Any four courses, minimum of 4 Credit Hrs)

S.No.	*Course Title*	*Code*	*Credit Hrs*
1.	Library and Information Services	PGS 501	1(0+1)
2.	Technical writing and communications skills	PGS 502	1(0+1)

3.	Intellectual Property and its management	PGS 503	1(1+0)
4.	Basic Concepts in Laboratory Techniques	PGS 504	1(0+1)
5.	Agriculture research, Research Ethics and Rural development Programmes	PGS 505	1(1+0)
6.	Disaster management	PGS 506	1(1+0)

F. Master's Thesis Research

S.No.	*Course Title*	*Code*	*Credit Hrs*
1.	Master's Research	ANN 699	20 (0+20)

Total Credit Hours: 29+11+20 =60

ANIMAL NUTRITION

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.

Cramptan 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. IndoVision.

ANN 602 Animal Nutrition – Minerals, Vitamins and Feed Additives 3+1

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

Theory

Unit 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 herbages. 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 Elsvier 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 runminant 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.
McEllihnery, 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.
McEllihnery 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 swineduring different stages of growth and production. Limiting iminoacids-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 l, Scott ML & John DS. 2001. Nutrition of the Chicken. Univ. of Guelph.

ANN 607 Nutrition of Companion, Laboratory, Wild and Zoo Animals 2+1

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.

ANN 610 General Animal Nutrition 1+1

Objective: To understand the importance of general information's on feed, fodder and their nutritional compoenents.

Theory

Unit I: Importance of nutrients in animal health and production, Composition of animal body and plants, Proximate composition and Chemical composition

Unit II: Importance of scientific feeding, Feeding experiments, Feed evaluation by digestion experiments, Feeding standards, their uses and significance

Unit III: Common feeds and fodders, their classification, availability and importance for livestock and poultry production, Preparation, storage and conservation of feeds and fodders, Unit IV: Introduction to

minerals, vitamins and various feed additives use in animal health and production, Low pollution feeds for environment friendly animal production, Recent trends in animal nutrition.

Practical

General preparation of solutions and indicators use in nutrition laboratories, Familiarisation of various feedstuff, fodder and their selection, Preparation and processing of samples for chemical analysis-herbage, faeces, urine and silage, Chemical composition and nutritive value of common feeds and fodders, Quality control of feeds, Basic principles in feed and ration formulation

Suggested Readings

Banerjee GC. 1988. Feeds and Principles of Animal Nutrition. Oxford & IBH.

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.

ANN 611 Special Problems in Animal Nutrition 0+2

Practical

Investigative nutritional problem in livestock and poultry feeding, didactic and interpersonal learning – teaching, problem solving and self learning strategies in problems related to animal nutrition

Suggested Readings

Standard Journals of animal nutrition and feed technology

Livestock Products Technology

A. Major –Livestock Products Technology (Minimum -29 Credit Hours)

S. No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1.	Fresh Meat Technology	LPT 601	2(1+1)
2.	Meat Processing, Packaging, Quality Control and Marketing	LPT 602	3(2+1)
3.	Poultry and Fish Products Technology	LPT 603	3(2+1)
4.	Egg and Egg Products Technology	LPT 604	2(1+1)
5.	Abattoir and Poultry Processing Plant Practices	LPT 605	2(1+1)
6.	Slaughter House Byproducts Technology	LPT 606	3(2+1)
7.	Processing and Marketing of Wool	LPT 607	3(2+1)
8.	Market Milk Processing and Dairy Plant Practices	LPT 608	3(2+1)
9.	Quality Control of Milk and Milk Products	LPT 609	2(1+1)
10.	Technology of Milk Products	LPT 610	3(2+1)
11.	In-Plant Training (Non Credit)	LPT 612	2(0+2)
12.	Master's Seminar	LPT 691	1(1+0)
Optional Courses			
1.	Biotechnology of Foods of Animal Origin	LPT-611	2(1+1)
2.	Marketing of Livestock Products	LPT-613	2(1+1)

B. Minor (Minimum 6-8 Credit Hours)

a. Prescribed Minor Subjects

Food Science and Technology, Biochemistry, Microbiology, Veterinary Public Health, Poultry Science, Livestock Production and Management

b. List of Courses for Minor in Department of Livestock Products Technology

S.No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1.	Basics of Livestock Products Technology	LPT-614	3 (2+1)
Optional Courses			
1.	Fresh Meat Technology	LPT 601	2(1+1)
2.	Meat Processing, Packaging, Quality Control and Marketing	LPT 602	3(2+1)
3.	Poultry and Fish Products Technology	LPT 603	3(2+1)
4.	Egg and Egg Products Technology	LPT 604	2(1+1)
5.	Abattoir and Poultry Processing Plant Practices	LPT 605	2(1+1)
6.	Slaughter House Byproducts Technology	LPT 606	3(2+1)
7.	Processing and Marketing Of Wool	LPT 607	2(1+1)
8.	Market Milk Processing and Dairy Plant Practices	LPT 608	3(2+1)
9.	Quality Control of Milk and Milk Products	LPT 609	2(1+1)
10.	Technology of Milk Products	LPT 610	3(2+1)
11.	Biotechnology Of Foods Of Animal Origin	LPT-611	2(1+1)
12.	Marketing Of Livestock Products	LPT-613	2(1+1)

C. Basic Supporting Courses (Minimum 3-5 Credit Hours)

S. No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1	Experimental Design	STAT-512	3 (2+1)

Optional Courses			
2	Mathematical Methods for applied Sciences	STAT 501	2 (2+0)
3	Statistical methods for applied sciences	STAT 511	4 (3+1)
4	Sampling Techniques	STAT 513	3 (2+1)
5	Applied Regression Analysis	STAT 521	3 (2+1)
6	Data Analysis using statistical packages	STAT 531	3 (2+1)
7	Student can opt any other course as per the need of research with the recommendation of advisory committee.		

D. Deficiency Courses (As per the need of student on the recommendation of advisory committee)

S. No.	Course Title	Code	Credit Hrs
Student can opt any course from the courses offering in university.			

E. Non Credit Compulsory Courses (Any four courses, minimum of 4 Credit Hrs)

S. No.	*Course Title*	*Code*	*Credit Hrs*
1.	Library and Information Services	PGS 501	1(0+1)
2.	Technical writing and communications skills	PGS 502	1(0+1)
3.	Intellectual Property and its management	PGS 503	1(1+0)
4.	Basic Concepts in Laboratory Techniques	PGS 504	1(0+1)
5.	Agriculture research, Research Ethics and Rural development Programmes	PGS 505	1(1+0)
6.	Disaster management	PGS 506	1(1+0)

F. Master's Thesis Research

S.No.	*Course Title*	*Code*	*Credit Hrs*
1.	Master's Research	LPT- 699	20 (0+20)

Total Credit Hours=29+11+20=60

LIVESTOCK PRODUCTS TECHNOLOGY

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 physicochemical 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 Control and Marketing 2+1

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- Barbecueing 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 – Demonstration 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, subjectice 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 slaughtter and slaughtering procedure-postmortem inspectionreasons for condemnation of carcass-yield and grading of dressed chicken,cutup 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, utilazation 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, irradication, curing, smoking, barbecuing, cooking and preparation of further processed poultry and fish products.

Practical

Organization, sanitation and maintenance of poultry processing plants. Slauhtering, ante-mortem and postmortem inspection, meat cutting, grading, production of ready to eat, smoked and cured poultry meatComminuted 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 capascitiy. 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 , posteurization of liquid egg, testing microbial load in different foams 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.
Suziki 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 slaughterhouseSanitary 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 utilazation.

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 byproducts 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 glandular products – Preparation of pet foods - Visit to local by-products, processing units.Quality evaluation of rendered animal fat.

Suggested Readings

Dilon M & Griffith C. 2001. Auditing in the Food Industry - From Safety and Quality to Environmental and other Audits. Woodhead Publ. Ltd.,UK.
GregoryNG. 1988. Animal Welfare and Meat Science. CABI.

Ockerman HW & Hansen CL. 2000. Animal by-product processing and utilization. Technomic Publ. Co. Ltd., Pennsylvania, USA.
Ockerman HW & Hansen CL. 2002. Animal Byproducts Processing and Utilization. CRC.

LPT 607 Processing and Marketing of Wool 2+1

Objective: To impart knowledge on grading, manufacturing process, marketing and specifications of wool and specialty fibers- growth and structure of wool and fiber, their use.

Theory

Unit I: Status and prospects of wool -Grading of wool. Faults and impurities in wool and their removal.

Unit II: Wool types and their uses. Growth and molecular structure of wool fibre; physical and chemical properties of wool. Characteristics of hair fibres and their use, factors influencing quality of wool and hair fibres - Principles and steps involved in manufacturing processes of wool- specialty hair fibres.

Unit III: Physical and chemical testing of wool. Proclaimed wool and secondary raw material - Marketing of wool, specification and regulation for quality control.

Practical

Visit to wool industry and acquaintance with various steps of manufacturing wool and its quality control, physical and chemical testing of wool. Characterization of wool, grading of wool.

Suggested Readings

Bergen WV. 1963. Wool Hand Book. Vols. I, II. InterScience.

LPT 608 Market Milk Processing and Dairyplant Practices 2+1

Objective: To impart knowledge about milk composition, legislation, milk processing techniques, cleaning and sanitation of dairy equipments.

Theory

Unit I: Milk standards and legislation and related agencies.

Unit II: Composition of milk, major and minor constituents of milk, physico-chemical, microbial and nutritional properties of milk and preservation of raw milk.

Unit III: Layout Designing and organization of dairy plant, Milk procurement, handling and transportation. Chilling, centrifugation, separation, clarification, bactofugation and homogenization. Thermal processing- pasteurization, UHT processing, sterilization, bactotherm and packaging, Storage and distribution of processed milk. Fortified, reconstituted and mild floured milks.

Unit IV: Membrane processing and related techniques; application of ultrafilteration, 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; biodetergents. 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- panneer- channa- ghee- ice cream- cheese-cheddar- Mozzorella and cottage cheese- khoa- dahi- yoghurt- casein- caseinate- coprecipate- 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

Unit I: Role of Biotechnology in productivity of livestock, Meat Speciation and quality control.

Unit II: Use of Biotechnology in production of food additive. Use of biotechnological tools for the processing and preservation and foods of animal origin

Unit III: Use of biotechnology improved enzymes in food processing industry, consumer concerns about risks and values, biotechnology and food safety.

Unit IV: 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 (Non Credit: Satisfactory/Unsatisfactory) 0+2

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.

LPT-613 Marketing of Livestock Products 1+1

Objective: To impart knowledge about various marketing tools and future scope for livestock products.

Theory

Unit I*:* Livestock Production and supply characteristics, meat and milk consumption and related demand, Types of market and trend in marketing of livestock products and by-products Wholesale, retail and future trends

Unit II: Consumer aptitude, education and awareness and popularization of new products, corporate bodies in regulation of markets, marketing boards, Co-operative agencies, internal trade

Unit III: Development of international market for livestock products, organization, operation and sanitation of milk, meat, poultry, fish and egg retailing units.

Unit IV: Fast food chains and super markets, Situation and outlook and methods for promotion and marketing of livestock products.

Practical

Survey of marketing trend of livestock products , economics of different milk and meat products, consumer demand and supply gaps, sustainability of supermarkets for livestock products and difficulties, supply chain of raw products and final livestock products, assumption for future trends in meat, milk, eggs and fish marketing .

Suggested Readings

Selected articles from journals.

LPT-614 Basics of Livestock Products Technology 2+1

Objective: To impart knowledge about basics of livestock products technology on various aspects.

Theory

Unit I: Composition and physic-chemical properties of cow and buffalo milk, Milk proteins, lipids, carbohydrates, minerals, vitamins and other minor constituents of milk, Nutritive value of milk, Reception of milk-platform tests, filtration and clarification, chilling, separation, standardization, pasteurization, and homogenization, , cleaning and sanitation of dairy equipments.

Unit II: Present status and future prospects of meat and poultry industry, Structure, composition, physical, biochemical and nutritive aspects and functional properties of different kinds of meat, fish, poultry and eggs, Sensory evaluation and organoleptic properties of livestock products, Postmortem aspect of muscle as food, ageing, of meat and chemical changes

Unit III: Meat in human health, bacteria, yeast, moulds, parasites important in food microbiology, general principles of spoilage, chemicals and deteriorative changes caused by micro-organisms, contamination and spoilage of meat, fish, poultry and eggs, food poisoning and food borne infections, assessment of microbial condition and wholesomeness of different livestock products, National and international microbial standards .

Practical

Proximate composition of milk and meat, platform tests of milk, fat, SNF, total solids, specific gravity, titrable acidity, pH, emulsion stability, extract release volume, cooking yield, Thiobarbituric acid value, Free fatty acid value, sensory evaluation of milk and meat 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.

Gracey JF. 1999. Thornton's Meat hygiene. 10th Ed. WB Saunders.

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.

DEPARTMENT OF VETERINARY GYNAECOLOGY AND OBSTETRICS

A. Major –Subject Veterinary Gynaecology and Obstetrics (Minimum -29 Credit Hours)

S.No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1	General Gynaecology	VOG 01	3+1
2	Female Infertility	VOG 02	3+1
3	Veterinary Obstetrics	VOG 03	2+2
4	Andrology & Male Infertility	VOG 04	3+1
5	Semen Preservation and Artificial Insemination	VOG 05	2+1
6	Reproductive Biotechnology	VOG 0	2+1
7	Clinical Practice I	VOG 07	0+3
8	Clinical Practice II	VOG 0	0+3
9	Master's Seminar	VOG 91	1+0
Optional Courses			
1	Regulations for embryo and frozen semen production	VOG 09	2+0
2	Canine reproduction and infertility	VOG 10	2+1

B. Minor (Minimum 6-8 Credit Hours)

a. Prescribed Minor Subjects

Veterinary Surgery & Radiology, Veterinary Physiology & Biochemistry, Veterinary Clinical Medicine, Ethics & Jurisprudence, Animal Biotechnology, Veterinary Pharmacology & Toxicology, Livestock production and management, Animal Breeding and genetics, Veterinary Microbiology, Animal Nutrition

b. List of Courses for Minor in Department of Veterinary Gynaecology & Obstetrics

S.No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1	General Gynaecology	VOG 01	3+1
Optional Courses			
2	Female Infertility	VOG 02	3+1
3	Veterinary Obstetrics	VOG 03	2+2
4	Andrology & Male Infertility	VOG 04	3+1
5	Semen Preservation and Artificial Insemination	VOG 05	2+1
6	Reproductive Biotechnology	VOG 0	2+1

C. Basic Supporting Courses (Minimum 3-5 Credit Hours)

S.No.	*Course Title*	*Code*	*Credit Hrs*	*Remark*
Core Courses				
1.	Experimental Design	STAT-512	3 (2+1)	As per ICAR
Optional Courses				
	As per students requirements and recommendations of advisory committee			

D. Deficiency Courses

(As per the need of student on the recommendation of advisory committee)

S.No.	*Course Title*	*Code*	*Credit Hrs*
Student can opt any course from the courses offered in the university.			

E. Non Credit Compulsory Courses (Any four courses, minimum of 4 Credit Hrs)

S.No.	*Course Title*	*Code*	*Credit Hrs*

1.	Library and Information Services	PGS 501	1(0+1)
2.	Technical writing and communications skills	PGS 502	1(0+1)
3.	Intellectual Property and its management	PGS 503	1(1+0)
4.	Basic Concepts in Laboratory Techniques	PGS 504	1(0+1)
5.	Agriculture research, Research Ethics and Rural development Programmes	PGS 505	1(1+0)
6.	Disaster management	PGS 506	1(1+0)

F. Master's Thesis Research

S.No.	*Course Title*	*Code*	*Credit Hrs*
1.	Master's Research	VOG 699	20 (0+20)

Total Credit Hours=29+11+20 =60

ANIMAL REPRODUCTION, GYNAECOLOGY & OBSTETRICS

VOG 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.

VOG 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.

VOG 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

Pelvimetory 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 Languge 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.

VOG 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.

VOG 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.

VOG 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.

VOG 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.

VOG 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.

VOG 609 Regulations for embryo and frozen semen production 2+0
Objective: To appraise the students about Govt. of India regulations regarding embryo and frozen semen production and dissemination.
Unit I: Biosecurity and biosafety guidelines for frozen semen station and embryo transfer laboratories
Unit II: Minimum standard protocol and standard operating procedures for bovine breeding
Unit III: Criteria for gradation of semen station and embryo transfer laboratory
Unit IV: Guidelines for export and import of bovine germplasm and embryos
Unit V: Minimum standards and standard operating procedures for artificial insemination
Unit IV: Quality testing of consumables used in semen processing, cryopreservation and in vitro and in vivo embryo production
Unit VII: Ultrasonography in Animal reproduction with special reference to PNDT act and registration of veterinary ultrasound machine
Suggested Readings
Gordon I. 2004. Reproductive Technologies in Farm Animals. CABI.
Hafez ESE. 2000. Reproduction in Farm Animals. Lippincott, Williams & Wilkins.
Selected journals related to animal reproduction

VOG 610 Canine reproduction and infertility 2+1
Objective: To appraise the students about fine details of canine reproduction and various reproductive disorders affecting the canines.
Theory
Unit I: Canine reproductive cycle and its endocrine control, Timing of ovulation and breeding management, Exfoliative vaginal cytology in canine reproduction
Unit II: Semen collection and artificial insemination in canines
Unit III: Canine Pregnancy and parturition, endocrine control of canine pregnancy, pregnancy diagnosis, assessment of fetal viability and age during gestation, parturition and post partum management, Care of new born puppy, Medical termination of pregnancy
Unit IV: Reproductive disorders in a bitch- vaginitis, vaginal prolapse, vaginal and vulvar neoplasia, transmissible venereal tumour, cystic endometrial hyperplasia / pyometra complex, subinvolution of placental sites, pregnancy loss, dystocia, pseudopregnancy, eclampsia (hypocalcemia or puerperal tetany), mastitis, galactostasis, agalactia and other reproductive disorders
Unit V: Common male reproductive disorders including disorders of testes and scrotum, prostate and penis and prepuce
Unit VI: Fertility control in bitches and dogs, Clinical examination of and infertile bitch and dog, amelioration of infertility in canines
Practical
Specificity of female genital organs morphology in carnivores, resected genital organs, technique of clinical examination, vaginoscopy, USG, diagnostic ultrasonography in canines for diagnosis of infertility, pregnancy diagnosis in canines, Determination of the estrous cycle phases and optimal time for mating including exfoliative vaginal cytology, semen collection in stud dogs using digital manipulation and AV method, artificial insemination in bitch, Pharmacological and immuno-contraception – presentation of methods and drugs, Orchiectomy and ovario hysterectomy of the dog, Conservative obstetric aid and caesarean section
Suggested Readings
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
Selected journals related to animal reproduction

Department of Veterinary Surgery & Radiology

A. Major Subject: Veterinary Surgery and Radiology (Minimum -29 Credit Hours)

S.No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1.	Principles of surgery	VSR 601	2+0
2.	Clinical practice – I	VSR 602	0+3
3.	Clinical practice – II	VSR 603	0+3
4.	Small animal anaesthesia	VSR 604	0+3
5.	Large animal anaesthesia	VSR 605	2+1
6.	Diagnostic imaging techniques	VSR 606	2+1
7.	Veterinary ophthalmology and dentistry	VSR 607	1+1
8.	Small animal soft tissue surgery	VSR 608	2+1
9.	Large animal soft tissue surgery	VSR 609	2+1
10.	Orthopaedic and limb surgery	VSR 610	2+1
11.	Master's seminar	VSR 691	1+0
Optional Courses			
1	Rehabilitation practices in veterinary surgery	VSR 611	1+1
2	Special problem in anaesthesia	VSR 612	0+2
3	Special problem in surgery	VSR 613	0+2
4	Special problem in diagnostic imaging	VSR 614	0+2

B. Minor (Minimum 6-8 Credit Hours)

a. Prescribed Minor Subjects

Veterinary Anatomy and Histology, Veterinary Pharmacology & Toxicology, Veterinary Pathology, Veterinary Physiology & Biochemistry, Animal Reproduction, Gynaecology and Obstetrics, Veterinary Medicine

b. List of Courses for Minor in Department of Veterinary Surgery & Radiology

S.No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1	Principles of surgery	VSR 601	2+0
Optional Courses			
1	Small animal anaesthesia	VSR 604	0+3
2	Large animal anaesthesia	VSR 605	2+1
3	Diagnostic imaging techniques	VSR 606	2+1
4	Veterinary ophthalmology and dentistry	VSR 607	1+1
5	Small animal soft tissue surgery	VSR 608	2+1
6	Large animal soft tissue surgery	VSR 609	2+1
7	Orthopaedic and limb surgery	VSR 610	2+1

C. Basic Supporting Courses (Minimum 3-5 Credit Hours)

S.No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1.	Experimental Design	STAT-512	3 (2+1)
Optional Courses			
As per need of the student research on recommendation of Advisory Committee			

D. Deficiency Courses (As per the need of student on the recommendation of advisory committee)

S.No.	*Course Title*	*Code*	*Credit Hrs*
Student can opt any course from the courses offering in university.			

E. Non Credit Compulsory Courses (Any four courses, minimum of 4 Credit Hrs)

S.No.	*Course Title*	*Code*	*Credit Hrs*
1.	Library and Information Services	PGS 501	1(0+1)
2.	Technical writing and communications skills	PGS 502	1(0+1)
3.	Intellectual Property and its management	PGS 503	1(1+0)
4.	Basic Concepts in Laboratory Techniques	PGS 504	1(0+1)
5.	Agriculture research, Research Ethics and Rural development Programmes	PGS 505	1(1+0)
6.	Disaster management	PGS 506	1(1+0)

F. Master's Thesis Research

S.No.	*Course Title*	*Code*	*Credit Hrs*
1.	Master's Research	VSR 699	20 (0+20)

Total Credit Hours=29+11+20 =60

VETERINARY SURGERY AND RADIOLOGY

VSR 601 Principles of Surgery **2+0**

Objective: To impart the basic knowledge of principles of surgery.

Theory

Unit I: Wound healing, current concepts of inflammation and management, wound infections, antimicrobial therapy, principles of surgical asepsis, sterilization and disinfection.

Unit II: Systemic effects of surgical stress, haemorrhage and haemostasis, metabolism of the surgical patient, fluid therapy in surgical patients, acidbase balance, shock. Hyperalimentation. Blood transfusion. Host defense mechanism.

Unit III: Biomaterials, surgical immunity, pre-operative assessment of the surgical patient, post-operative care of the surgical patient. Chemotherapy of tumors.

Unit IV: Operating room emergencies, cardio-pulmonary embarrassment and resuscitation, monitoring of surgical patient.

Unit V: Principles of laser surgery, cryosurgery, electrosurgery, lithotripsy and endoscopy, physiotherapy, stem cell therapy etc.

Suggested Readings

Fossum TW. (Ed.). 2002. Small Animal Surgery. Mosby.
Slatter DH. (Ed.). 2002. Textbook of Small Animal Surgery. 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. 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 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 postoperative 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 conjuctiva, 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 paracentasis, 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.
Oehme FW & Prier JE. (Ed.). 1994. Textbook of Large Animal Surgery. Williams & Wilkins. Tyagi RPS & Singh J. (Eds.). 1993. Ruminant Surgery. CBS.
Selected articles from journals.

VSR 611 Rehabilitation Practices in Veterinary Surgery 1+1

Objective: To acquaint about techniques on rehabilitation practices in veterinary surgery
Theory
Unit I: Manual methods of rehabilitation like massage, range of motion exercises, acupuncture.
Unit II: Physical methods of rehabilitation: cold therapy, heat therapy including diathermy, therapeutic ultrasound and exercises including treadmill and other exercises.
Unit III: Orthotics like Splints, slings and wheelcarts.
Unit IV: Artificial Prosthetics in animals.
Unit V: Emerging modalities like LASER, Pulse magnetic wave therapy, TENS (only introduction).
Unit VI: Kinetic and kinematic analysis of gait.
Unit VII: Rehabilitation of orthopaedic patients.
Practical
Familiriazation to the acupuncture therapy, diathermy, therapeutic ultrasound. Development and designing of orthotics like splints, slings and wheelcart/wheelchair. Development and designing of artificial prosthetics. Introduction to gait analysis. Measuring range of motion, goniometry.
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.
Selected articles from journals.

VSR 612 Special Problem in Anaesthesia 0+2
Objective: To acquaint about techniques on anaesthesia
Practical
Investigative anaesthetic problems in clinical or experimental models, didactic and interpersonnel learning-teaching, problem solving self-learning strategies in problems related to anaesthesia.

Suggested Readings
Selected articles from journals.

VSR 613 Special Problems in Surgery 0+2
Objective: To acquaint about problem oriented surgical techniques
Practical
Investigative surgical problems in clinical or experimental models, didactic and interpersonnel learning-teaching, problem solving self-learning strategies in problems related to surgery

VSR 614 Special Problem in Diagnostic Imaging 0+2
Objective: To acquaint about techniques on diagnostic imaging
Practical
Investigative diagnostic imaging problems in clinical cases, edifying and interpersonnel learning-teaching, self-learning strategies related to imaging techniques.
Suggested Readings
Selected articles from journals.

Suggested Readings
Selected articles from journals.

Department of Veterinary Medicine

*A. Major – Veterinary Medicine (Minimum -29 Credit Hours)**

S. No.	*Course Title*	*Code*	*Cr Hrs*
Core Courses			
1	Ruminant medicine - I	VMD 601	3 (3+0)
2	Ruminant medicine - II	VMD 602	3 (3+0)
3	Equine medicine	VMD 603	2 (2+0)
4	Canine and feline medicine	VMD 604	2 (2+0)
5	Avian medicine	VMD 605	2 (2+1)
6	Diseases of animal species of regional importance	VMD 606	2 (1+1)
7	Metabolic diseases	VMD 607	2 (2+0)
8	Diseases of animals caused by toxicants	VMD 608	1 (1+0)
9	Veterinary forensic medicine	VMD 609	2 (1+1)
10	Clinical diagnostic techniques	VMD 610	2 (0+2)
11	Clinical practice - I	VMD 611	3 (0+3)
12	Clinical practice - II	VMD 612	3 (0+3)
13	Master's seminar	VMD 691	1 (1+0)
Optional Courses			
1	Veterinary emergency medicine	VMD 613	2 (0+2)

B. Minor (Minimum 6-8 Credit Hours)

a. Prescribed Minor Subjects

Veterinary Surgery & Radiology, Veterinary Pharmacology & Toxicology, Animal Reproduction, Gynaecology and Obstetrics, Veterinary Public Health & Epidemiology, Veterinary Pathology

b. List of Courses for Minor in Department of Veterinary Medicine

S. No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1	Ruminant medicine - I	VMD 601	3 (3+0)
Optional Courses			
2	Ruminant medicine - II	VMD 602	3 (3+0)
3	Equine medicine	VMD 603	2 (2+0)
4	Canine and feline medicine	VMD 604	2 (2+0)
5	Avian medicine	VMD 605	2 (2+1)
6	Diseases of animal species of regional importance	VMD 606	2 (1+1)
7	Metabolic diseases	VMD 607	2 (2+0)
8	Diseases of animals caused by toxicants	VMD 608	1 (1+0)
9	Veterinary forensic medicine	VMD 609	2 (1+1)
10	Clinical diagnostic techniques	VMD 610	2 (0+2)

C. Basic Supporting Courses (Minimum 3-5 Credit Hours)

S. No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1	Experimental Design	STAT 512	3 (2+1)
Optional Courses			
1	Mathematical Methods for applied Sciences	STAT 501	2 (2+0)
2	Statistical methods for applied sciences	STAT 511	4 (3+1)
3	Sampling Techniques	STAT 513	3 (2+1)
4	Applied Regression Analysis	STAT 521	3 (2+1)
5	Data Analysis using statistical packages	STAT 531	3 (2+1)
6	Student can opt any other course as per the need of research with the recommendation of advisory committee.		

D. Deficiency Courses (As per the need of student on the recommendation of advisory committee)

S. No.	*Course Title*	*Code*	*Credit Hrs*
Student can opt any course from the courses offering in university			

E. Non Credit Compulsory Courses (Any four courses, minimum of 4 Credit Hrs)

S. No.	*Course Title*	*Code*	*Credit Hrs*
1.	Library and Information Services	PGS 501	1(0+1)
2.	Technical writing and communications skills	PGS 502	1(0+1)
3.	Intellectual Property and its management	PGS 503	1(1+0)
4.	Basic Concepts in Laboratory Techniques	PGS 504	1(0+1)
5.	Agriculture research, Research Ethics and Rural development Programmes	PGS 505	1(1+0)
6.	Disaster management	PGS 506	1(1+0)

F. Master's Thesis Research

S. No.	*Course Title*	*Code*	*Credit Hrs*	*Remark*
1.	Master's Research	VMD 699	20 (0+20)	As ICAR syllabus page no. 8

Total Credit Hours = 29+11+20 = 60

VETERINARY MEDICINE

VMD 01 Ruminant Medicine - I **3+0**

Objective: Study of diseases of various body systems, bacterial and viral diseases of bovine, sheep and goats.

Theory

Unit I: General systemic states.Diseases of alimentary system, liver and urinary system.

Unit II: Diseases of respiratory, nervous .cardiovascular, blood and blood forming organs, musculoskeletal system and skin.

Unit III: Mastitis, joint ill, ulcerative lymphangitis, anthrax, clostridial infections, black quarter, bacillary haemoglobinuria, botulism, colibacillosis.pasteurellosis, listeriosis, tuberculosis, Johne's disease, braxy, entero-toxaemia, brucellosis, salmonellosis, leptospirosis. actinomycosis, actinobacillosis.

Unit IV: Foot and mouth disease, mucosal disease complex, PPR, malignant head catarrh, infectious bovine rhinotracheitis, rabies, scrapie, louping ill, blue tongue, pox diseases, rinderpest and ephemeral fever.

Suggested Readings

Constable, P.D., Hinchcliff, K.W., Done, S.H. and Grunberg, W (2017). Veterinary Medicine: A textbook of diseases of cattle, horses, sheep, pigs and goats.11th Ed. Elseveir

Chakrabarti A. 1998. *Text Book of Clinical Veterinary Medicine*. Kalyani.

VMD 02 Ruminant Medicine - II **3+0**

Objective: Study of parasitic and fungal diseases of bovine, sheep and goats.

Theory

Unit I: Ringworm, cutaneous sporotrichosis, aspergillosis, coccidiodomycosis, rhinosporidiosis, mucormycosis, histoplasmosis, candidiasis, blastomycosis.

Unit II: Bovine tropical theileriosis, babesiosis, anaplasmosis, trypanosomiosis, toxoplasmosis, coccidiosis.

Unit III: Sarcocystosis, fascioliosis, amphistomiosis, gastrointestinal nematodiosis, schistosomiosis, verminous bronchitis, echino-coccosis, coenurosis, tape worm infestations.

Suggested Readings

Constable, P.D., Hinchcliff, K.W., Done, S.H. and Grunberg, W (2017). Veterinary Medicine: A textbook of diseases of cattle, horses, sheep, pigs and goats.11th Ed. Elseveir

VMD 03 Equine Medicine **2+0**

Objective: Study of etiology, epidemiology, pathogenesis, symptomatology, diagnosis, treatment and prevention of diseases of equines.

Theory

Unit I: General systemic states and diseases of various body systems (alimentary, urinary, respiratory, nervous .cardiovascular, blood and blood forming organs, musculoskeletal and integumentary).

Unit II: Anthrax, tetanus, botulism, strangles, glanders, malignant edema, actinomycosis, clostridial infections, African horse sickness, infectious equine anaemia, equine influenza, equine encephalomyelitis, equine viral rhinopneumonitis, equine viral arteritis, ulcerative lymphangitis.*Rhodococcus equi* pneumonia.

Unit III: Trypanosomiasis/ dourine, babesiosis, parasitic pneumonia.cutaneous eczema, cutaneous acne, cutaneous pustular dermatitis, candidiasis, histoplasmosis, coccidiodomycosis, dermatophytosis.

Suggested Readings

Robison NE. 1997. *Current Therapy in Equine Medicine*. WB Saunders.

Wintzer HJ. 1986. *Equine Diseases, a Text Book for Students and Practioners.* Verlaug Paul Parcey.

Constable, P.D., Hinchcliff, K.W., Done, S.H. and Grunberg, W (2017). *Veterinary Medicine: A textbook of diseases of cattle, horses, sheep, pigs and goats*.11th Ed. Elseveir.

VMD 04 Canine and Feline Medicine 2+0

Objective: Study of etiology, epidemiology, pathogenesis, symptomatology, diagnosis and treatment of diseases of dogs and cats.

Theory

Unit I: General systemic states, hypothyroidism, diabetes mellitus, diabetes insipidus, rickets.

Unit II: Bacterial diseases: leptospirosis, , tetanus, botulism. Viral diseases: canine- distemper, infectious canine hepatitis, parvovirus infection, rabies, corona virus infection.

Unit III: Parasitic diseases: toxoplasmosis, neosporosis, sarcoptic mange, demodectic mange, hookworm and toxocara canis infections, leishmaniasis, canine babesiosis, ehrlichiosis, hepatozoonosis.

Unit IV: Feline diseases: feline pan-leucopaenia, feline infectious peritonitis, feline herpesvirus, feline spongiform encephalopathy, feline calci and feline immuno-deficiency viral diseases.

Suggested Readings

Dunn JK. 1999. *Textbook of Small Animal Medicine*. WB Saunders.

Ettinger SJ & Feldman EC. 2000. *Text Book of Veterinary Internal Medicine*. Vols. I, II. Saunders.

Gorman NT. 1998. *Canine Medicine and Therapeutics*. Blackwell.

Tilley LP & Smith FWK Jr. 2004. *The 5-minute Veterinary Consult (Canine and Feline)*.3rd Ed. Lippincot, Williams & Wilkins.

VMD 05 Avian Medicine 2+1

Objective: Study of etiology, epidemiology, pathogenesis, symptomatology, diagnosis and treatment of diseases of avian species.

Theory

Unit I: Diseases due to deficiency of vitamins (vitamins A, B complex, C, D,E and K); minerals (calcium, phosphorus, manganese, zinc) and sodium chloride; miscellaneous diseases/conditions/ vices.

Unit II: Bacterial diseases: *Escherichia coli* and salmonella infections, coryza, fowl cholera, gangrenous dermatitis, mycoplasmosis, CRD

Unit III: Viral diseases: Newcastle disease, infectious bursal disease, Marek's disease, infectious bronchitis, inclusion body hepatitis, hydro-pericardium syndrome, avian pox, infectious laryngo-tracheitis, avian influenza, lymphoid leucosis, avian encephalomyelitis, infectious bronchitis.

Unit IV: Fungal and parasitic diseases: aspergillosis, candidiosis, favus, mycotoxicosis, coccidiosis, roundworm and tape worm infestations, vaccination schedule etc

Practical

Post-mortem examination of poultry birds, collection of clinical material for laboratory diagnosis.

Suggested Readings

Calnek BW, Barnes HA, Beard CW, Reid WM & Yoder HW Jr. 1999. *Diseases of Poultry*. 10th Ed. Iowa State Univ. Press.

Jordan ETW and Pattison, M. 1996. *Poultry Diseases*. WB Saunders.

Leeson S, Diaz G & Summers JD. 2001. *Poultry Metabolic Disorders and Mycotoxins*.IBDC Publ.

VMD 0 Diseases of Animal Species of Regional Importance (Swine) (1+1)

Objective: Study of diseases of important regional animal species (camel).

Theory

Unit I: General infectious diseases: anthrax, actinomycosis, black quarter, bronchitis, coccidiosis, contagious echthyma, haemorrhagic septicaemia, hydatidosis, mange, mastitis, camel pox, rabies, surra, tuberculosis etc.

Unit II: Swine diseases: Swine influenza, hog cholera, African swine fever, swine pox, vesicular

exanthema, vesicular stomatitis, rabies.
Unit III: Porcine enteroviruses, pseudorabies, listeriosis, leptospirosis, brucellosis, anthrax, salmonellosis, swine erysipelas, pasteurellosis, tuberculosis mange etc.
Practical
Recent diagnostic tests and preventive measures for the control of infectious diseases of swine. Investigations of outbreaks. Visits to organized farms.
Suggested Readings
Dunne HW & Leman AD. (Eds.). 1978. *Diseases of Swine*. Iowa State Univ. Press.
Constable, P.D., Hinchcliff, K.W., Done, S.H. and Grunberg, W (2017). Veterinary Medicine: A textbook of diseases of cattle, horses, sheep, pigs and goats.11th Ed. Elseveir

VMD 07 Metabolic Diseases 2+0
Objective: Study of metabolic, production and deficiency diseases of domestic animals.
Theory
Unit I: General aspects, production diseases (parturient paresis, downer cow syndrome, ketosis, post-parturient haemoglobinuria, hypomagnesemic tetany, pregnancy toxaemia).
Unit II: Lactation tetany of mares, eclampsia of bitches, osteodystrophia fibrosa, azoturia of equines, rheumatism-like syndrome in buffaloes, hypothyroidism, diabetes mellitus and diabetes insipidus in dogs.
Unit III: Deficiency diseases (calcium, phosphorus, vitamin-D3, vit-A, vit B-complex, vit-C and vit-K).
Unit IV: Deficiency diseases (iron, copper, cobalt, zinc, manganese, iodine, vitamin E and selenium).
Suggested Readings
Dunn JK. 1999. *Text Book of Small Animal Medicine*. WB Saunders.
Constable, P.D., Hinchcliff, K.W., Done, S.H. and Grunberg, W (2017). Veterinary Medicine: A textbook of diseases of cattle, horses, sheep, pigs and goats.11th Ed. Elseveir

VMD 0 Diseases of Animals Caused Bytoxicants 1+0
Objective: Study of diseases caused by various toxicants in domestic animals.
Theory
Unit I: Diseases caused by physical agents and poisoning of organic and inorganic compounds. farm chemicals and phytotoxins.
Unit II: Diseases caused by mycotoxins and zootoxins, poisonous plants, snake and insect bites.
Suggested Readings
Kahn Cynthia M. (Ed.). 2005. *The Merck Veterinary Manual*. Merck & Co.
Constable, P.D., Hinchcliff, K.W., Done, S.H. and Grunberg, W (2017). Veterinary Medicine: A textbook of diseases of cattle, horses, sheep, pigs and goats.11th Ed. Elseveir

VMD 09 Veterinary Forensic Medicine
Objective: To familiarize students with various aspects of Veterinary Forensic Medicine.
Theory
Unit I: Veterolegal aspects of ante mortem and post mortem examination.
Unit II: Examination of wounds, blood, offenses, frauds in animals and their products, animal cruelty and welfare.
Unit III: Study of common laws related to veterolegal aspects.
Practical
Ante- mortem and post- mortem examination, examination of wounds, blood, offenses, frauds in animals and their products, collection, dispatch and examination of veterolegal samples.
Suggested Readings
Sharma SN, Gahlot AK, Tanwer RK. 2003. *Veterinary Jurisprudence*. NBS Publishers, Bikaner.

VMD 10 CLINICAL DIAGNOSTIC TECHNIQUES 0+2

Objective: Study the diagnostic protocols and procedures for various diseases of farm and companion animals.

Practical

Unit I: Clinical tests and their interpretation related to diseases of alimentary tract, liver, cardio vascular system, blood and blood-forming organs of various species of animals.

Unit II: Clinical tests and their interpretation related to respiratory, urinary, nervous, endocrine, musculoskeletal and integumentary systems of various species of animals.

Suggested Readings

Kelly WR. 1984. *Veterinary Clinical Diagnosis*. Balliere Tindall, London.

Kaneko JJ, Harvey JW & Bruss ML. 2008. *Clinical Biochemistry of Domestic Animals*. 6th Ed. Academic Press, Amsterdam.

VMD 11 Clinical Practice - I 0+3

Objective: Application of the theoretical concepts in practice**.**

Practical

Diagnostic and therapeutic protocol application, specimen collection, examination and management of diseased farm and companion animals.

Note: This course will be conducted in VCC (Veterinary Clinical Complex), where students shall participate in diagnosis and treatment of diseased animals.

VMD 612 Clinical Practice – II 0+3

Objective: Application of the theoretical concepts in practice.

Practical: Diagnostic and therapeutic protocol application, specimen collection, examination and management of diseased farm and companion animals.

Note:This course will be conducted in VCC (Veterinary Clinical Complex), where students shall participate in diagnosis and treatment of diseased animals.

VMD 613 Veterinary Emergency Medicine 0+2

Objective: Diagnosis and therapeutic management of various medical emergencies in farm and companion animals.

Practical

Unit I: Diagnosis and therapeutic management of various emergencies of cardiovascular, respiratory, gastrointestinal, urinary and nervous systems,

Unit II: Diagnosis and therapeutic management of various emergencies of toxicities, sting bites and burns of farm and companion animals.

Unit III: Monitoring critical ill patient, application of emergency care procedures for resuscitation of critically ill patient

Suggested Reading

Kirk RW.1995. *Handbook of Veterinary Procedures and Emergency Treatment.* 6th Ed. WB Saunders.

Sattler FP & Knowles W. 2001. *Veterinary Critical Care*. Lea & Febiger.

Department of Veterinary and A.H. Extension Education

A. Major: Veterinary and Animal Husbandry Extension Education (Minimum -29 Credit Hours)

S.No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1	Fundamentals of Veterinary and Animal Husbandry Extension	AHE 601	2+1
2	Communication for Livestock Development	AHE 602	1+1
3	Diffusion and Adoption of Animal Husbandry Practices	AHE 603	2+1
4	Extension Techniques and Audio Visual Aids	AHE 604	2+1
5	Animal Husbandry Programme Planning and Evaluation	AHE 605	2+1
6	Research Methodology in Veterinary and Animal Husbandry Extension	AHE 606	2+1
7	Social Psychology and Group Dynamics	AHE 607	2+1
8	Animal Husbandry Development Programmes	AHE 608	1+0
9	Developments in the Concept of Extension	AHE 609	1+0
10	Gender and Livestock Development	AHE 611	1+0
11	Master's Seminar	AHE 691	1+0
Optional Courses			
1	Human Resource Management in Animal Husbandry Sector	AHE 610	2+1
2	Information and Communication Technology in Livestock Development	AHE 612	1+1
3	Livestock Entrepreneurship (New Course)	AHE 613	2+1
4	Farm Journalism (New Course)	AHE 614	2+1

B. Minor (Minimum 6-8 Credit Hours)

a. Prescribed Minor Subjects

Animal Nutrition, Animal Genetics & Breeding, Animal Reproduction, Gynaecology and Obstetrics, Livestock Production and Management, Veterinary Public Health, Veterinary Epidemiology and Preventive Medicine

b. List of Courses for Minor in Department of Vetterinary and Animal Husbandry Extension Education

S.No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1	Fundamentals of Veterinary and Animal Husbandry Extension	AHE 601	2+1
2	Animal Husbandry Development Programmes	AHE 608	1+0
Optional Courses			
Other courses offered by the Department will be opted as per need of student and on the recommendation of advisory committee			

C. Basic Supporting Courses (Minimum 3-5 Credit Hours)

S.No.	*Course Title*	*Code*	*Credit Hrs*
Core Courses			
1.	Experimental Design	STAT 512	3 (2+1)
Optional Courses			
Other courses will be offered to the student as per the need of the programme.			

D. Deficiency Courses (As per the need of student on the recommendation of advisory committee)

S.No.	*Course Title*	*Code*	*Credit Hrs*
Student can opt any course from the courses offering in university.			

E. Non Credit Compulsory Courses (Any four courses, minimum of 4 Credit Hrs)

S.No.	*Course Title*	*Code*	*Credit Hrs*
1.	Library and Information Services	PGS 501	1(0+1)
2.	Technical writing and communications skills	PGS 502	1(0+1)
3.	Intellectual Property and its management	PGS 503	1(1+0)
4.	Basic Concepts in Laboratory Techniques	PGS 504	1(0+1)
5.	Agriculture research, Research Ethics and Rural development Programmes	PGS 505	1(1+0)
6.	Disaster management	PGS 506	1(1+0)

F. Master's Thesis Research

S.No.	*Course Title*	*Code*	*Credit Hrs*
1.	Master's Research	AHE 699	20 (0+20)

Total Credit Hours=29+11+20 =60

VETERINARY AND ANIMAL HUSBANDRY EXTENSION

AHE 601 Fundamentals of Veterinary and Animal Husbandry Extension 2+1

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.

Samanta RK. (Ed). 1990. Development Communication for Agriculture. BR Publ. Corp., Delhi.

Swanson BE. (Ed). 1984. Agricultural Extension: A Reference Manual. 2nd Ed. FAO.

Van den Ban AW & Hawkins HS. 1998. Agricultural Extension. Longman Scientific Tech.

AHE 602 Communication For Livestock Development 1+1

Objective: To acquaint the students with concept and models of communication and to improve their communication skills

Theory

Unit I: Communication- meaning, concept, purpose and process.

Unit II: Models and theories of communication. Types of communication- intrapersonal, interpersonal, verbal and non-verbal. Criteria of effective communication, Determinants of communication- Empathy, credibility, fidelity, distortion, feed back and barriers to communication.

Unit III: Group and mass communication. Modern communication technologies. Key communicators and their role in animal husbandry development.

Practical

Exercises in oral communication and group discussion. Exercises in written communication. Writing for newspapers, magazines. Script writing for radio and TV. Client management in veterinary clinics . Identification of key communicators in a village.

Suggested Readings

Cragan FJ. & Wright WD. 1999. Communication in Small Groups – Theory, Process, Skills. Wadsworth Publ.

Mcquail D & Windahl S. 1993. Communication Models for the Study of Mass Communications. Longman Publ.

Ray GL. 1991. Extension, Communication and Management. Naya Prokash.
Rogers EM & Shoemaker FF. 1971. Communication of Innovations: A Cross – Cultural Approach. The Free Press.
Roloft Michael F. 1981. Interpersonal Communication. Sage Publ.
Servaes J, Thomas LJ. & Whitle AS. (Ed). 1997. Participatory Communication for Social Change. Sage Publ.

AHE 603 Diffusion and Adoption of Animal Husbandry Practices 2+1

Objective: To sensitize the students towards technology generation, dissemination and its adoption through effective communication.

Theory

Unit I: Concept of diffusion. Elements in diffusion process, models and theories of diffusion. Decision-making, Stages in diffusion-adoption process.

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 nonadoption 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 & Whitle 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 Methodologies in Veterinary and Animal Husbandry Extension 2+1

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 nonexperimental 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

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.

AHE 612 Information and Communication Technology in Livestock Development 1+1

Objective: To apprise the students about information system, networking and use of various ICT tools.

Theory

Unit 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. Sag

AHE 613 Livestock Entrepreneurship 2+1

Objectives: To orient the students on basic concepts of entrepreneurship and the initiatives in promoting livestock as an enterprise. To impart knowledge in the various facets of entrepreneurial management and consumer behaviour for establishment of livestock ventures.

Theory

Unit I: Entrepreneurship - Role of Entrepreneurship in Economic Development of the country and current scenario and future; Factors influencing Entrepreneurship (Internal factors, External factors, Political factors, Socio - Cultural Environment, Legal and Technological Environment); Role of Government and Non-Government agencies in promoting entrepreneurship in India.

Unit II: Agri-Business Plan: Business Idea Generation, Brainstorming and Evaluation of ideas, Industry Study, Product Development, Product Features, Market Survey, Assessing the demand potential.

Competition, scalability of the product, Price feasibility, Distribution and Logistics Ease of Technology, Opportunities and Threats, Internal Strengths and Weaknesses (SWOT analysis) Government Regulations and statutory compliances, Sources of Financial Assistance.
Unit III: Agri-Business Evaluation: Evaluating Financial Feasibility, Cost of Production and Marketing, Project Cost Determination and Fund requirement, assessing Working Capital Requirement, Non-fund based Requirements (BG, LC), Cost of Capital Sources and Cost of Finance. Technical Feasibility, Patents, Make or Buy Decision, Plant Size and Location, Machinery Requirement, Outsourcing Requirements, Type of Company to start and its Advantages to the Promoter. Project Report and Appraisal Techniques- Net Present Value, Payback period, Break even analysis, CBRatio
Unit IV: Consumer Behaviour : Consumer Behaviour- Definition, Consumer and Customers, Buyers and Users, Organisations as Buyers, Development of Marketing Concept, Consumer Behaviour and its Applications in Livestock Marketing; **C**onsumer behaviour models; Consumer Motivation, Consumer Perception, Consumer Behaviour and Marketing Communications, Consumer Decision-making Process, Organizational Buying Behaviour, Modern marketing information system (marketing intelligence, communicating and acting on marketing intelligence).
Suggested Readings
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 614 Farm Journalism 2+1

Objective: To sensitize students about the role of print, electronic, digital and internet media for promoting animal husbandry sector.
Theory
Unit I: Concept of farm journalism and communication. Journalism as a means of mass communication and its role in livestock development. Opportunities, strength and limitations. Ethics and principles of journalism for effective writing.
Unit II: Writing skills - art of writing, news items, news stories, feature articles, success stories, magazines, bulletins, folders etc. Fundamentals of lay-out in writing. Writing of research papers and popular articles in journals, farm magazines and e-journals. Methods and techniques of broadcasting of farm programmes. Writing scripts for radio and televisions.
Unit III: Types of internet based media- Writing for web- concepts, Writing for social media (Blogs etc) – Ethics and values. Development of Multimedia Modules .
Unit IV: Rapport building with different categories of clients involved in veterinary and animal husbandry extension programmes. Art of speaking. Importance of listening and reading. Writing for press news.Relations with press media. Event management, Organization of press meet. Qualities of a good public relations manager.
Practical
Designing and preparation of news stories, feature articles, success stories related to animal husbandry. Designing and preparation of magazines, folders, popular research articles, radio, T.V. scripts and social media. Visit to Agricultural Technology Information and Communication (ATIC) centre to record the activities of preparation, editing and publication of news articles and research publications.
Suggested Readings
Selected articles from Journals.

VETERINARY MICROBIOLOGY

A. Major Courses :

CODE	COURSE TITLE	CREDITS
VMC 01	Bacteriology – I	3+1
VMC 02	Bacteriology – II	3+1
VMC 03	Veterinary Mycology	1+1
VMC 04	General Virology	2+1
VMC 05	Systematic Animal Virology	3+1
VMC 0	Principles Of Immunology	2+1
VMC 07	Vaccinology	2+0
VMC 0	Diagnostics Of Infectious Diseases	1+2
VMC 09	Techniques In Microbiology And Immunology	0+3
VMC 91	Master's Seminar	1+0
VMC 99	Master's Research	20

B. Minor Courses

Animal Biotechnology, Veterinary Epidemiology & Preventive Medicine, Veterinary Pathology, Veterinary Public Health, Veterinary Biochemistry

C. Supporting courses: any subject considered relevant for students research work.

VETERINARY MICROBIOLOGY

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, *Dermatophillaceae*, *Streptomycetaceae.*

Unit II: *Mycobacteria* and *Nocardia*, family *Actinomycetaceae*. Atypical prokaryotes such as *Chlamydia*, *Rickettsiae*, *Mycoplasma*, *Acholeplasma*, *Spiroplasma*, *Anaeroplasma* and *Thermoplasma*.

Unit III: Regular non-sporing Gram positive rods such as *Listeria* and *Erysipelas*. 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. 200 . *Fundamentals of Molecular Virology*. Wiley.
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 lyrangeotracheitis virus, Marek's disease virus, pseudorabies virus, malignant cattarrh fever virus; infectious canine hepatitis virus, egg drop syndrome virus, inclusion body hepatitis- hydropericardium virus, papiollomatosis, 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). 19 . *Manual of Clinical Laboratory Immunology*. American Society for Microbiology.

Weir DM. 19 . *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. 199 . *Virology Methods Manual*. Academic Press.

Quinn PJ, Carter ME, Markey B & Carter GR. 1994. *Clinical Veterinary Microbiology*. Wolfe.Publ.

VETERINARY PATHOLOGY

A. Major Courses

CODE	COURSE TITLE	CREDITS
VPP 01	General Pathology	2+1
VPP 02	Techniques In Pathology	1+1
VPP 03	Animal Oncology	1+1
VPP 04	Clinical Pathology	1+2
VPP 05	Necropsy Procedures And Interpretations –I	0+1
VPP 0	Necropsy Procedures And Interpretations –II	0+1
VPP 07	Systemic Pathology	2+1
VPP 0	Pathology Of Infectious Diseases Of Domestic Animals	2+1
VPP 09	Toxicopathology	2+1
VPP 10	Avian Pathology	2+1
VPP 11	Pathology Of Laboratory Animals, Fish And Wild Animals	2+1
VPP 12	Veterolegal Pathology	1+0
VPP 91	Master's Seminar	1+0
VPP 99	Master's Research	20

B. Minor Courses:
Veterinary Microbiology, Veterinary Anatomy and Histology, Veterinary Clinical Medicine, Ethics & Jurisprudence, Veterinary Parasitology, Veterinary Pharmacology & Toxicology, Animal Nutrition

C. Supporting courses: any subject considered relevant for students research work.

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. Hypersentivity 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-I **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

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

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. 200 . *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

Unit1: 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.

VETERINARY BIOCHEMISTRY

A. Major Courses

Code	Course Title	Credits
VBC 01	Chemistry Of Animal Cell	2+0
VBC 02	Techniques In Biochemistry	0+2
VBC 03	Applications Of Genomics And Proteomics In Molecular Biology	2+0
VBC 04	Biochemistry Of Biomolecules: Carbohydrates, Lipids And Membrane's Structure	2+0
VBC 05	Enzyme Catalysis, Kinetics, Inhibition And Regulation	2+0
VBC 0	Metabolism-I: Carbohydrates And Lipids	2+0
VBC 07	Metabolism-Ii: Nucleic Acids And Amino Acids	2+0
VBC 0	Metabolism-Iii: Integration And Regulation.	2+0
VBC 09	Central Dogma And Protein Function	2+0
VBC 10	Clinical Biochemistry Of Animals	2+1
VBC 11	Biochemical Basis Of Diseases Of Domestic Animals	2+0
VBC 12	Endocrinology And Reproductive Biochemistry	2+0
VBC 13	Biochemical Basis Of Animal Production	2+1
VBC 91	Master's Seminar	1+0
VBC 99	Master's Research	20

B. Minor Courses:
Veterinary Physiology, Veterinary Microbiology, Veterinary Clinical Medicine, Ethics & Jurisprudence, Animal Biotechnology, Veterinary Pharmacology & Toxicology, Animal Nutrition, Animal Genetics & Breeding.
C. Supporting courses: any subject considered relevant for students research work.

VBC 601 Chemistry of Animal Cell **2+0**
Objective: Teaching of principles of physical chemistry as applicable to veterinary sciences.
Theory
Unit I: Pre-biotic world, chemical evolution. cellular architecture, molecular organization and metabolic function.
Unit II: Thermodynamics, chemical equilibrium, standard state, living cell as steady state, open system obeying laws of thermodynamics. Minimum energy conformation, quantum mechanical calculation. G and ATP.
Unit III: 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. *Physical Chemistry for the Bioscience*. Univ. Science Books. Dvorak AM & Harris W. 1991. *Blood Cell Biochemistry*. 2nd Ed. Plenum. Garby L. 1995. *Bioenergetics*. Cambridge.
Voet D, Voet JG & Pratt CW. 2006. *Fundamentals of Biochemistry of Life at the Molecular Level*. 2nd 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 co- efficient, 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. *Lehninger's Principles of Biochemistry*. 4th 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, Ruminal 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, Ca^{2+}, Ion–gradient, Gap Junction, Cl--HCO_3-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. G, 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- -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.
Glasel 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, proteosome, 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 pyramidine 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 Pres
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, Ca^{2+}, 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 Pres
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 dimmer, 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 immuno- deficiency.

Unit IV: Hepatic insufficiencies and its laboratory assessment. Pancreatitis and insuffiency. 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 harmone 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.

VETERINARY PHYSIOLOGY

A. Major Coures

Code	Course Title	Credits
VPY 01	Physiology Of Digestion	2+1
VPY 02	Cardiovascular And Respiratory Physiology	2+1
VPY 03	Renal Physiology And Body Fluid Dynamics	2+1
VPY 04	Haematology	2+1
VPY 05	Vitamins And Minerals In Animal Physiology	2+0
VPY 0	Physiology Of Animal Reproduction	2+1
VPY 07	Clinical Physiology	2+1
VPY 0	Neuromuscular Physiology	2+1
VPY 09	Chemical Bioregulation In Physiological Functions	3+0
VPY 10	Research Techniques In Veterinary Physiology	0+2
VPY 91	Master's Seminar	1+0

B. Minor Courses:
Veterinary Anatomy and Histology, Veterinary Biochemistry, Veterinary Pharmacology & Toxicology, Animal Nutrition, Animal Reproduction Gynaecology and Obstetrics, Livestock Production and Management, Animal Genetics & Breeding

C. Supporting courses: any subject considered relevant for students research work.

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 spirometery, 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. Permselectivity 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 Endocrionology*. 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.

VPY 610 Research Techniques in Veterinary Physiology 0+2

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.

ANIMAL GENETICS AND BREEDING

A. Major Coures

Code	Course Title	Credits
AGB 01	Animal Cytogenetics And Immunogenetics	2+1
AGB 02	Molecular Genetics In Animal Breeding	2+1
AGB 03	Population And Quantitative Genetics In Animal Breedding	2+1
AGB 04	Selection Methods And Breeding Systems	3+1
AGB 05	Biometrical Techniques In Animal Breeding	3+1
AGB 0	Conservation Of Animal Genetic Resources	2+0
AGB 07	Cattle And Buffalo Breeding	2+1
AGB 0	Small Farm Animal Breeding (Sheep, Goat, Swine And Rabbit)	2+0
AGB 09	Poultry Breeding	2+1
AGB 10	Laboratory Animal Breeding	1+0
AGB 91	Master's Seminar	1+0
AGB 99	Master's Research	20

B. Minor Courses:
Genetics, Animal Biotechnology, Statistics, Livestock Production and Management, Vety. Gynecology & Obstetrics, Animal Reproduction, Vety. Physiology, Vety. Biochemistry, Poultry Science, Animal Nutrition.
C. Supporting courses: any subject considered relevant for students research work.

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 in Animal Breeding 2+1

Objective

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

Theory

Unit I: Individual verses population. Genetic Structure of population. Factors affecting changes in gene and genotypic frequencies and their effect on genetic structure of animal popultions. Approach to equalibrium under differnet 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 popultion 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 orf inbreeding in regular and irregular systems. Estimation of effective population size. Computation of quantiatative 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 plateux 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 polymorphysim 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.Compuatation of realized heritability and genetic correlation. Selection index: Computation, Accuracy and response in component traits.Estimation of hetrerosis 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 bio metrical 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 Jl. 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 buffallo and their Characterisation.Inheritance of important economic traits. Recording and handeling 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 matrenal grand sire model. Open nucleus breeding systems with MOET.

Unit III: Methods of cross breeding.Breeding of type, milk quality and production efficency. 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 assocaitions 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*. 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 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-Breedingrecords 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.

LIVESTOCK PRODUCTION AND MANAGEMENT

A. Major Coures

Code	Course Title	Credits
LPM 01	Cattle And Buffalo Production And Management	2+1
LPM 02	Sheep And Goat Production And Management	2+1
LPM 03	Swine Production And Management	1+1
LPM 04	Laboratory Animal Production And Management	1+1
LPM 05	Shelter Management	1+1
LPM 0	Principles Of Environmental Hygiene And Waste Management	2+0
LPM 07	Climatology And Animal Production	1+0
LPM 0	Poultry Farm And Hatchery Management	2+1
LPM 09	Farm Animal Behavior	1+0
LPM 10	Integrated Livestock Farming System	2+1
LPM 11	Equine Production And Management	1+1
LPM 12	Wild Life Management And Conservation	2+0
LPM 13	Livestock Business Management	1+1
LPM 91	Master's Seminar	1+0
LPM 99	Master's Research	20

B. Minor Courses:
Animal Nutrition, Animal Genetics & Breeding, Livestock Products Technology and Veterinary and Animal Husbandry Extension
C. Supporting courses: any subject considered relevant for students research work.

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, Tupping

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 Laboratoray 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 .

Theory

UNIT 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.

Theory

Unit 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 poutry, 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 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 prodcution

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-a-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-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'Donnel 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.

VETERINARY PARASITOLOGY

A. Major Coures

Code	Course Title	Credits
VPA 01	Veterinary Helminthology-I	2+1
VPA 02	Veterinary Helminthology-Ii	2+1
VPA 03	Veterinary Entomology And Acarology	2+1
VPA 04	Veterinary Protozoology	2+1
VPA 05	Parasitological Techniques	0+2
VPA 0	Clinical Parasitology	1+1
VPA 07	Trends In Control Of Livestock And Poultry Parasites	1+1
VPA 0	Immunoparasitology	2+1
VPA 09	Parasitic Zoonoses	2+0
VPA 10	Parasites Of Zoo And Wild Animals	2+1
VPA 11	Malacology	1+1
VPA 91	Master's Seminar	1+0
VPA 99	Master's Research	20

B. Minor Courses:
Veterinary Epidemiology & Preventive Medicine, Veterinary Microbiology, Veterinary Pharmacology & Toxicology, Animal Biotechnology, Veterinary Pathology, Veterinary Biochemistry

C. Supporting courses: any subject considered relevant for students research work.

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

Diphyllobothriidae.

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 EJL. 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 EJL. 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 *Haemobartonell.a*
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 Aghriculture, 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 EJL. 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 parasiticidal 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, immumomodulations 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*. Wileyliss Publication, New York.

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

VPA 609 Parasitic Zoonoses 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 EJL & 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.

VPA 611 Malacology 1+1
Objective: To learn about the details of various snails involved in diseases transmission.
Theory
Unit 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.p
Suggested Readings
Malek EA & Cheng TC. 1974. *Medical and Economic Malacology*.
Academic Press.
Sturm CF, Pearce TA & Valdes A. 2006. *The Mollusks: A Guide to Their Study, Collection and Preservation*. American Malacological Society, Pittsburgh and Universal Publishers, Boca Rato.