NEW AND RESTRUCTURED POST-GRADUATE CURRICULA & SYLLABI

Basic Veterinary Subjects

Veterinary Anatomy & Histology
Veterinary & Animal Husbandry Extension
Veterinary Biochemistry
Veterinary Physiology

Education Division
Indian Council of Agricultural Research
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Contents

EXECUTIVE SUMMARY

I. The New Approach

The proposed course curricula and syllabi in veterinary science disciplines have been prepared in the light of PG programmes in vogue at different veterinary colleges in India and contemporary developments in veterinary sciences. The guiding principle of the proposed new approach is to impart comprehensive and practical knowledge by covering all important aspects of the subject area of study at Master's level. It is proposed that each MVSc student should register for all the courses offered by the major department, e.g. an MVSc student in microbiology should study all basic courses of bacteriology, virology and immunology instead of opting for courses of 1 or 2 sub-disciplines only. However, flexibility has been retained at Ph.D. level.

II. Credit Requirements

Common academic regulations for post graduate education in SAUs, DUs and CAU as proposed in table 2 will be followed with slight adjustments to accommodate specific and special needs to build up and enhance the knowledge based competence of the veterinary students as given below.

- The total course work of 40 credit hours has been proposed at M.V.Sc. level instead of minimum requirement 35 credit hours, keeping the research credit hours (20) unchanged. Break up of the course work: Major subject (including 1 credit seminar) - 29 credits, minor subject (specified in Table-1) and supporting subjects together (as per requirement) -11 credits.
- At Ph.D. level, it is proposed to keep course credit hours (30) and research credit hours (45) unchanged. However, break up of the course work: Major subject (including 2 credit seminars) - 19 credits, minor subject (specified in Table-1) and supporting subject together (as per requirement) -11 credits.
- Out of 11 credit hours for minor and supporting subjects, courses with a minimum of 6 credit should be taken from minor subject and courses with a minimum of 3 credit hours from supporting subject 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.
- The credit hours for minor and supporting subjects both at Master's and Doctoral level have been reduced to compensate partially for the increased credit load of courses of major subject.
- It is proposed that clinical practice of 0+3 credit hours should be made compulsory in the two semesters for all MVSc students in departments of Clinical Medicine, Ethics & Jurisprudence, Surgery & Radiology, and Animal Reproduction, Gynaecology & Obstetrics.
- Besides, four general non-credit 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) are mandatory at Master's level, and at Doctoral level, if not studied already.

- The undergraduate courses for B.V.Sc. & A.H. students, formulated and implemented uniformly in all veterinary colleges of India under statutory provisions of Veterinary Council of India, are up to 500 series. To avoid overlapping and confusion generated thereof, the numbering of courses is also revised i.e., 600 series for MVSc and 700 for Ph. D. programme.

III. Major additions and alterations in the existing PG courses

Veterinary Anatomy and Histology

To enhance the comprehension, the courses have been redesigned to teach system-wise detailed anatomical structures, besides facilitating learning of regional anatomy. Latest anatomical, histological, histochemical and histoimmunochemical techniques in vogue, have been earmarked for practical classes to encourage hands on training to PG students. Major emphasis in re-designed courses has been clinical application of the basic knowledge of anatomy and histology. All the masters' and doctoral courses have been improved significantly to include the latest development in the field e.g. basics of bio-mechanics of the locomotor system, radiography of normal and developing bones; surgical sites for various operations and clinically significant areas for performing clinical examination. Ultra structural studies of organs and tissues have been incorporated where-ever required.

- VAN 606 (General histology and ultrastructure) and VAN 607 (Systemic histology and ultrastructure) courses have included ultrastructural studies on General Histology.
- VAN 701 [Myology, angiology, neurology and anesthesiology of equine, canine and porcine]; VAN 706 [Theory and applications of electron microscope]; VAN 707 [Histoenzymology and immunocytochemistry]; VAN 708 [Applied embryology and teratology] and VAN 710 [Gross anatomy of laboratory animals] are newly designed doctoral courses.

Veterinary and Animal Husbandry Extension

To ensure that academic and scientific developments in all fields of veterinary sciences and Animal Husbandry get translated into adoption by the beneficiaries, framing of contemporary courses in VAHE became essential.

- The course AHE 607 [Social psychology and group dynamics] is redesigned to focus on social psychology and addition of group dynamics as an essentiality of today's work environment.
- The course AHE 609 [Developments in the concept of extension] is a new course designed to acquaint students with recent developments in extension education.
- The course AHE 611 [Gender and livestock development] is a new course designed to acquaint the students with the concept of gender, its importance in livestock development, livestock development policies and the government programmes to empower women.

- The course AHE 612 [Information and communication technology in livestock development] is a new course designed to apprise the students about information system, networking and use of various ICT tools.
- AHE 702 [Farm journalism and public relations] designed to sensitize students about the role of mass media, news papers, magazines, radio, T.V. and internet for promoting animal husbandry.
- AHE 705 [Policies & regulations in livestock sector] designed to sensitize the students about policies and regulations in animal husbandry sector.
- AHE 706 [Educational technology] designed to acquaint students with different concepts of education technology.
- AHE 708 [Organizational communication] designed to sensitize the students towards communication and networking to increase the efficiency of an organization.

Veterinary Biochemistry

- VBC 601 [Chemistry of animal cell] is refabricated to emphasize the application of organic chemistry principles to clinical diseases of animals
- VBC 603 [Applications of genomics and proteomics in molecular biology] is largely re-formatted to lay greater emphasis on clinical and industrial application of proteins and genome, e.g. drug resistance, regulation of pathogen pathways etc.
- VBC 605 [Enzyme catalysis, kinetics, inhibition and regulation] redesigned to lay more emphasis on animal disease control by regulation and inhibition mechanisms.
- VBC 608 [Metabolism-iii: integration and regulation] designed to highlight disorders due to failed integration and regulation, e.g. Obesity, diabetes, cancer, poisoning, stress, apoptosis, liver and renal diseases, acid base imbalance etc.
- VBC 613 [Biochemical basis of animal production] designed to teach biochemistry of draft capacity, meat production and dairy chemistry.
- VBC 701 [Advances in biochemistry of ruminant disorders] designed to give exposure to developments in ruminant disorders associated with metabolism.
- VBC 705 [Methods in protein analysis] designed to teach latest advances in characterization of proteins in health & disease.

Veterinary Physiology

- VPY 610 [Research techniques in veterinary physiology] designed to train students in recording of ECG, EMG, Physiograph, GLC, Electrophoresis, body composition using radio-isotopes, *in vitro* and *in sacco* rumen studies, ELISA.
- VPY 709 [Advances in rumen microbiology and metabolism] designed to teach rumen ecosystem and symbiotic relationship of flora and fauna, their structure and functions, rumen manipulation techniques etc.
- VPY 710 [Advances in immunophysiology] designed to study cells and organs of immune system, its development and role in physiological functions and immunomodulation.
- VPY 711 [Physiology of stress] designed to teach the mechanism and effect of stress on production and reproduction in domestic animals.

BSMA Committee on Basic Veterinary Sciences

(Vety. Anatomy, Basic Physiology, Biochemistry, Stat., Extension, Economics)

(Constituted by ICAR vide Office order No. F. No. 13 (1)/2007- EQR dated January 14, 2008)

Name	Address	Specialization
Dr. Dharmeshwar Das ***Convenor***	IVRI, Izatnagar	Genetics
Dr. V. K. Kansal Head	Animal Biochemistry Division, NDRI, Karnal	Biochemistry
Dr. S. D. Singh Prof. & Head	CIFE, Mumbai	
Dr. Geetha Ramesh Prof. & Head	Dept. of Vety. Anatomy & Histology, Madras Vety. College, Chennai	Anatomy & Histology
Dr. S. K. Rastogi Prof. & Head	Dept. of Vety. Physiology, GBPUAT, Pantnagar	Physiology
Dr. S.V.N. Rao Prof. & Head	Dept. of VAHE, Rajiv Gandhi College of Vety. & Animal Sciences, Podicherry	Extension
Dr. Rajesh Nigam Registrar	Dept. of Vety. Biochemistry, Vety. College, Mathura	Biochemistry
Dr. J. S. Bhatia Prof. & Head	Dept of Vety. Physiology, Appolo College of Vety. Medicine, Jaipur	Physiology
Dr. S.K. Nagpal Dean ***Member Secretary***	College of Vety. Sciences, CCS HAU Hisar	Anatomy

PREAMBLE

Veterinary sciences have helped in reducing animal sufferings, minimizing risk of zoonotic diseases threatening human health and ensuring food security. There have been unprecedented advancements in all the branches of veterinary sciences. The futuristic requirements of the society such as integrated casualty management, public health, food security and safety, healthy eco-system, containing bio-terrorism, productivity, profitability and stability of livestock farming systems etc., have posed greater challenges for veterinary academics and scientific community. Veterinarians with higher qualifications are increasingly being involved in devising means and methods of developing diagnostics against prevalent and emerging pathogens, prevention and control of animal diseases and zoonoses, eco-health stewardship, monitoring and surveillance of diseases of livestock and poultry, combating bio-terrorism, genetic engineering to optimize production and develop disease resistant breeds of animals. Bio-medical research, being heavily dependent upon animal experimentation, demands deeper scientific knowledge of veterinary sciences. Temporal aspirations of knowledge seekers ought to be addressed through building knowledge and skill portfolio suiting the job market and thus enhancing the marketability of the veterinary post graduates

In this perspective, it is important that the veterinary profession responds to the futuristic societal needs to remain relevant and purposeful. Recent advances in veterinary medical sciences have led to wide spread use of animal disease surveillance and prediction system, 3-D holographic animal models, robotic tele-surgery, globe-wide virtual class rooms and demonstration centers, sensor diagnostic facilities etc. The dominant forces shaping the Veterinary-Business and Veterinary-education are global and virtual with a large number of specialists offering tele-veterinary services from off-shore locations like India. The ever changing and demanding public service sector has necessitated re-look into the veterinary higher education.

At undergraduate level, veterinary students acquire comprehensive knowledge and skills in basic, para-clinical and clinical subjects required for performing multi-tasking role of a veterinarian. However, at post graduate level, in-depth knowledge of theory, practical aspects and research methodology in each subject is of paramount importance. Detailed study of the course curricula and syllabi, being implemented by veterinary colleges in India, revealed that there was enormous heterogeneity in the course structure, nomenclature and contents. Informal discussions amongst veterinary academicians, over

the years, referred to the need to train good teachers and researchers with comprehensive subject knowledge rather than narrow sub-specialization of a discipline at Master's level. In view of the above, the task of formulating need based contemporary post graduate courses and syllabi for implementation of post graduate education uniformly at national level was initiated.

Three BSMA committees, constituted by ICAR for restructuring of masters and doctorate course curricula and syllabi, worked in unison to formulate common basic format. The BSMA committees consisted of [1]Basic Veterinary Sciences (Anatomy and Histology; Veterinary & Animal Husbandry Extension; Biochemistry and Physiology); [2]Veterinary Para-clinical Sciences (Microbiology, Parasitology, Pathology, Pharmacology & Toxicology, Public Health) and [3]Veterinary Clinical Sciences (Animal Reproduction, Gynaecology & Obstetrics; Clinical Medicine, Ethics and Jurisprudence; Epidemiology & Preventive Medicine and Surgery & Radiology).

The Master's programme in basic veterinary subjects aims at providing cutting edge concepts as well as practical applications of these exciting fields. The new and restructured Post-Graduate curricula and syllabi in respect of basic, paraclinical and clinical veterinary sciences documents contain several innovative and practically applicable courses and extensively revamped course contents viz. inclusion of imaging techniques, ultra-structural studies and clinical applications in the curricula of veterinary anatomy; emphasis on cell membrane dynamics, receptor biology and proteomics in relation to various animal diseases in veterinary biochemistry; focus on rumen microbiology and metabolism, immuno-physiology and physiology of stress in veterinary physiology; framing of courses on social psychology, group dynamics, gender and livestock development, planning and monitoring, organizational management and information and communication technology in the veterinary and animal husbandry extension.

Para-clinical veterinary subjects, which provide essential support by employing disease diagnostics technologies for prevention and control of animal diseases, directing efforts for Green Earth, maintenance of biodiversity etc., have been redesigned in the light of general recommendations of the BSMA committees on veterinary sciences. Courses have been re-designed in such a manner that an MVSc student in Microbiology studies all aspects of bacteriology, virology, mycology and immunology. The contents of 17 courses of microbiology and 14 courses of immunology have been reshaped and encapsulated into 9 mandatory courses of 600 series and 18 optional courses of 700 series have been carved

in veterinary microbiology. In veterinary parasitology, new courses on malacology, remote sensing and GIS have been introduced. In veterinary pathology, courses on veterolegal pathology and toxico-pathology have been introduced. A new course on ethno-pharmacology has been introduced in veterinary pharmacology while courses on fish, fish products and seafood hygiene; disaster management and bioterrorism; emerging and reemerging zoonoses; occupational health hazards; disposal and recycling of waste; biohazards and bio-security have been introduced in veterinary public health.

The new approach encompassed the latest knowledge for development of advanced diagnostics, clinical management, clinical epidemiology, bio-security, prevention and control of diseases of livestock and poultry including zoonoses like Bird Flu, Rabies, Tuberculosis, Brucellosis etc. New courses on 'Herd Health management', 'Ecology', 'Forensic Medicine', 'Emergency Medicine', 'Diagnostic Imaging Techniques,' 'Survey and Surveillance', 'Diseases of Zoo, Wild and Laboratory Animals' etc. have been framed and contents of other courses were heavily revised to include the latest developments. To encourage clinical practice in the veterinary clinics, courses of Clinical Practice each at MVSc and PhD level have been made mandatory. To focus on learning of research methodology, scientific thinking, planning and experimentation, a course for special problems has been introduced in all the subjects.

Teaching Veterinary Clinical Service Complex, along with clinical departments and diagnostic laboratories, provides yeoman's service to stake holders in the field of animal health. The up-gradation of the clinical services will go a long way in meeting the expectations and demands for advanced diagnosis, therapeutics and prophylaxis. The state of infra-structure, manpower (both technical and support staff) and contingencies attached to clinical service units in veterinary colleges in India, requires immediate attention of policy planners to support and supplement in terms of liberal financial grants.

The implementation of the new and restructured post graduate course curricula is expected to build knowledge and skill portfolio of the students so as to enhance their employability and marketability as multi-service providers with practical skills and comprehensive knowledge of the entire subject area after masters. The doctorates should, in turn, prove as specialists, in the field of their specialization. The valuable inputs received from the stake holders viz. eminent academicians, scientists, extension workers, pharmaceutical/ dairy industry, leading veterinary practitioners, state animal husbandry department etc. have immensely helped in preparation of this document.

ORGANIZATION OF COURSE CONTENTS
&
CREDIT REQUIREMENTS

Code Numbers

- All courses are divided into two series: 600-series courses pertain to Master's level, and 700-series to Doctoral level. A Ph. D. student must take a minimum of two 700 series courses, but may also take 600-series courses if not studied during Master's programme.
- Credit seminar for Master's level is designated by code no. 691, and the two seminars for Doctoral level are coded as 791 and 792, respectively.
- Similarly, 699 and 799 codes have been given for Master's research and Doctoral research, respectively.

Course Contents

The contents of each course have been organized into:

- Objective – to elucidate the basic purpose.
- Theory units – to facilitate uniform coverage of syllabus for paper setting.
- Suggested Readings – to recommend some standard books as reference material. This does not unequivocally exclude other such reference material that may be recommended according to the advancements and local requirements.
- A list of journals pertaining to the discipline is provided at the end which may be useful as study material for 600-series courses as well as research topics.
- E-Resources - for quick update on specific topics/events pertaining to the subject.
- Broad research topics provided at the end would facilitate the advisors for appropriate research directions to the PG students.

Minimum Credit Requirements

Subject	Master's programme	Doctoral programme
Major	28	17
Minor + Supporting (minimum 6 for minor & 3 for supporting)	11	11
Seminar	01	02
Research	20	45
Total Credits	**60**	**75**
Compulsory Non Credit Courses	See relevant section	

Major subject: The subject (department) in which the students takes admission
Minor subject: The subject closely related to students major subject. A suggested list of specified minor subjects is given in Table 1.
Supporting subject: The subject not related to the major subject. It could be any subject considered relevant for student's research work.
Non-Credit Compulsory Courses: Please see the relevant section for details. Six courses (PGS 501-PGS 506) are of general nature and are compulsory for Master's programme. Ph. D. students may be exempted from these courses if already studied during Master's degree.

Table 1. Suggested list of specified minor subjects (Departments)

Major Subject	Minor Subjects*
Veterinary Anatomy and Histology	Veterinary Pathology, Veterinary Surgery and Radiology, Veterinary Physiology, Veterinary Biochemistry
Veterinary and Animal Husbandry Extension	Veterinary Epidemiology and Preventive Medicine, Veterinary Public Health, Animal Reproduction Gynecology & Obstetrics, Livestock Production and Management. Animal Nutrition, Animal Genetics & Breeding, Poultry Science
Veterinary Biochemistry	Veterinary Physiology, Veterinary Microbiology, Veterinary Clinical Medicine, Ethics & Jurisprudence, Animal Biotechnology, Veterinary Pharmacology & Toxicology, Animal Nutrition, Animal Genetics & Breeding
Veterinary Physiology	Veterinary Anatomy and Histology, Veterinary Biochemistry, Veterinary Pharmacology & Toxicology, Animal Nutrition, Animal Reproduction Gynaecology and Obstetrics, Livestock Production and Management, Animal Genetics & Breeding

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

VETERINARY ANATOMY AND HISTOLOGY

Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
VAN 601	COMPARATIVE OSTEOLOGY AND ARTHROLOGY	1+2
VAN 602	COMPARATIVE SPLANCHNOLOGY	2+2
VAN 603	MYOLOGY, ANGIOLOGY, NEUROLOGY AND AESTHESIOLOGY OF OX	1+3
VAN 604	GROSS ANATOMICAL TECHNIQUES	0+2
VAN 605	THEORY AND PRACTICE OF HISTOLOGICAL AND HISTOCHEMICAL TECHNIQUES	1+2
VAN 606	GENERAL HISTOLOGY AND ULTRASTRUCTURE	3+1
VAN 607	SYSTEMIC HISTOLOGY AND ULTRASTRUCTURE	3+1
VAN 608	DEVELOPMENTAL ANATOMY	3+1
VAN 691	MASTER'S SEMINAR	1+0
VAN 699	MASTER'S RESEARCH	20
VAN 701	MYOLOGY, ANGIOLOGY, NEUROLOGY AND AESTHESIOLOGY OF EQUINE, CANINE AND PORCINE	0+3
VAN 702	PRINCIPLES AND APPLICATIONS OF BIOMECHANICS	2+0
VAN 703	AVIAN ANATOMY	1+2
VAN 704	NEUROANATOMY	3+1
VAN 705	ENDOCRINE ANATOMY	2+1
VAN 706	THEORY AND APPLICATIONS OF ELECTRON MICROSCOPE	2+1
VAN 707	HISTOENZYMOLOGY AND IMMUNOCYTOCHEMISTRY	2+1
VAN 708	APPLIED EMBRYOLOGY AND TERATOLOGY	1+2
VAN 709	FUNCTIONAL VETERINARY ANATOMY	2+0
VAN 710	GROSS ANATOMY OF LABORATORY ANIMALS	1+1
VAN 790	SPECIAL PROBLEM	0+2
VAN 791	DOCTORAL SEMINAR I	1+0
VAN 792	DOCTORAL SEMINAR II	1+0
VAN 799	DOCTORAL RESEARCH	45

VETERINARY ANATOMY AND HISTOLOGY

Course Contents

VAN 601 COMPARATIVE OSTEOLOGY AND ARTHROLOGY 1+2

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

Classification and detailed study of different joints of the body.

UNIT V

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

Practical

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

Suggested Readings

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

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

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

VAN 602 COMPARATIVE SPLANCHNOLOGY 2+2

Objective

To give a detailed overview of different systems constituting splanchnology.

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

UNIT II

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

UNIT III

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

UNIT IV

Complete study of the gross anatomy of various sense organs.

UNIT V

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

Practical

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

Suggested Readings

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

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

Schummer A, Wickens H & Vollmerhaus B. 1981. *Circulatory System, Skin and Skin Organs of Domestic Mammals*. Verlag Paul Parey.

Seiferle E. 1975. *Nervous System, Sensory Organs, Endocrine Glands of Domestic Mammals*. Verlag Paul Parey.

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

VAN 604 GROSS ANATOMICAL TECHNIQUES 0+2

Objective

Hands-on training for preparation of gross anatomical specimens**.**

Practical

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

Suggested Readings

Luna LG. 1968. *Manual of Histologic Staining Methods of the Armed Forces Institute of Pathology*. McGraw-Hill.

Tompsett DH & Wakeley SC. 1956. *Anatomical Techniques*. E & W Living Stone.

VAN 605 THEORY AND PRACTICE OF 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 701 MYOLOGY, ANGIOLOGY, NEUROLOGY AND AESTHESIOLOGY OF EQUINE, CANINE AND PORCINE 0+3

Objective

To teach students about anatomy of muscles, blood vessels, nervous tissue and sense organs in equine, canine and porcine.

Practical

Dissection of different body regions with respect to muscles, blood vessels and nerves; and see the topographic positioning of different organs in different body cavities in equine, canine and porcine.

Suggested Readings

Selected articles from journals.

VAN 702 PRINCIPLES AND APPLICATIONS OF BIOMECHANICS 2+0

Objective

To sensitize the student about the importance of biomechanics**.**

Theory

UNIT I

Biomechanics, its definition and scope with reference to anatomy and physiology of domestic animals and musculo-skeletal dynamics.

UNIT II

Locomotion and clinical applications. Biomechanics of cortical and trabecular bones.

UNIT III

Biomechanics of fracture fixation. Instrumentation and techniques in locomotion and their applications in lameness.

Suggested Readings

Selected articles from journals.

VAN 703 AVIAN ANATOMY 1+2

Objective

To give detailed overview of poultry anatomy.

Theory

UNIT I

The study of the gross features of different body systems of domestic fowl.

UNIT II

The study of microscopic features of different body systems of domestic fowl.

Practical

Dissection and demonstration of various body systems of fowl and turkey. Microscopic examination of slides of various organ systems of fowl.

Suggested Readings

Selected articles from journals.

VAN 704 NEUROANATOMY 3+1

Objective

To provide in-depth knowledge of nervous system.

Theory

UNIT I

The gross and microscopic anatomy of the brain and spinal cord.

UNIT II

Study of various cranial and spinal nerves along with their associated nuclei and ganglia.

UNIT III

Motor and sensory pathways, different ascending and descending tracts of brain and spinal cord and autonomic nervous system.

Practical

Gross dissection and microscopic examination of the brain and spinal cord; demonstration of the nerves, nerve plexuses, ganglia of cranial importance, study of the serial sections of the brain and spinal cord in domestic animals.

Suggested Readings

Selected articles from journals.

VAN 705 ENDOCRINE ANATOMY 2+1

Objective

To project the importance and details of endocrine glands**.**

Theory

UNIT I

Advanced gross and microscopic anatomy of the hypothalamus and pituitary gland.

UNIT II

Advanced gross and microscopic anatomy of the thyroid, parathyroid and thymus.

UNIT III

Advanced gross and microscopic anatomy of the adrenal glands, islets of Langerhans, pineal body and other tissues associated with endocrine secretions.

Practical

Demonstration of the topographic anatomy in the embalmed specimens and microscopic examination of the endocrine glands of ruminants.

Suggested Readings

Selected articles from journals.

VAN 706 THEORY AND APPLICATIONS OF ELECTRON MICROSCOPE 2+1

Objective

To give an overview of the electron microscope.

Theory

UNIT I

Introduction and principles of electron microscopy.

UNIT II

Methods for transmission electron microscopy.

UNIT III

Methods for scanning electron microscopy.

Practical

Preparation of blocks and demonstration of various techniques used for carrying out TEM and SEM.

Suggested Readings

Selected articles from journals.

VAN 707 HISTOENZYMOLOGY AND IMMUNOCYTOCHEMISTRY 2+1

Objective

To give a student hands-on practice for various advanced histoenzymic and histochemical techniques.

Theory

UNIT I

Classification of enzymes – Principles of enzymes histochemistry methods.

UNIT II

Substrates –combination–coupling azo-dye methods –capture reagents.

UNIT III

Localization of enzymes and controls in enzyme histochemistry.

UNIT IV

Fluorescence microscopy in enzyme histochemistry. Immunohistochemistry- principles and techniques.

Practical

Preparation of fixatives and buffers used in histochemistry. Methods of preparations and microscopical examination of routine and special preparations showing different cell organelles and inclusions. Methods for tryptophan-SS, SH groups; Glycogen-glycoproteins; Mucopolysaccharides and lipids. Methods and identification of alkaline and acid phosphatases – succinic dehydrogenase, cytochrome- oxidase, choline-esterase, catecholamines by fluorescence microscopy. Immunohistochemistry – principles and techniques.

Suggested Readings

Selected articles from journals.

VAN 708 APPLIED EMBRYOLOGY AND TERATOLOGY 1+2

Objective

To apprise the students about the current trends in developmental processes.

Theory

UNIT I

Principles of experimental embryology and teratology.

UNIT II

Factors affecting the developmental mechanisms of embryo.

UNIT III

Use of organizers implants, chemical and hormonal preparations in the developmental models and available literature on teratogenic experimentation.

Practical

Collection and study of various teratological specimens from domestic animals. Class discussions on experimental models and available literature on teratogenic experimentation.

Suggested Readings

Selected articles from journals.

VAN 709 FUNCTIONAL VETERINARY ANATOMY 2+0

Objective

To make the student understand the functional anatomy of various organs/systems in relation to structure.

Theory

UNIT I

The relationship of structure to form and function.

UNIT II

The relationship of structure for adaptation and behaviour.

UNIT III

Relationship of structure in relation to clinical conditions/ applications.

Suggested Readings

Selected articles from journals.

VAN 710 GROSS ANATOMY OF LABORATORY ANIMALS 1+1

Objective

To give an overview of different body systems of laboratory animals.

Theory

UNIT I

Study of different organs of digestive system of different laboratory animals.

UNIT II

Detailed study of urinary, male and female reproductive systems of different laboratory animals.

UNIT III

Complete study of respiratory system of different laboratory animals

UNIT IV

Study of organs of circulation and nervous system of different laboratory animals.

UNIT V

Descriptive anatomy of endocrine glands of different laboratory animals.

Practical

Demonstration of placement and relations of different organs in the body cavities of different laboratory animals.

Suggested Readings

Papesko P, Rajtova V & Horak J. 2002. *A Colour Atlas of Anatomy of Small Laboratory Animals: Rabbit, Guinea Pig*. 2nd Ed. Wolfe Publ.

VAN 790 SPECIAL PROBLEM 0+2

Objective

To provide expertise in handling practical research problem(s).

Practical

Short research problem(s) involving contemporary issues and research techniques.

VETERINARY ANATOMY AND HISTOLOGY

List of Journals

* Acta Anatomica
* American Journal of Anatomy
* Anatomia Histologia and Embryologia
* Anatomical Record
* Anatomy and Embryology
* Indian Journal of Veterinary Anatomy
* Journal of Anatomy

e-Resources

* http://www.interscience.wiley.com/journal/117927935/grouphome/home.html (American Journal of Anatomy)
* http://www.ovid.com/site/catalog/Journal/1057.jsp (Journal of Anatomy)
* http:http:www.interscience.wilety.com/jpages/0003-276X/ (Anatomical Record)
* http://www.blackwellpublishing.com/submit.asp (Anatomia Histologia and Embryologia)

Suggested Broad Topics for Master's and Doctoral Research

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

VETERINARY AND ANIMAL HUSBANDRY EXTENSION

Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
AHE 601	FUNDAMENTALS OF VETERINARY AND ANIMAL HUSBANDRY EXTENSION	2+1
AHE 602	COMMUNICATION FOR LIVESTOCK DEVELOPMENT	1+1
AHE 603	DIFFUSION AND ADOPTION OF ANIMAL HUSBANDRY PRACTICES	2+1
AHE 604	EXTENSION TECHNIQUES AND AUDIO VISUAL AIDS	2+1
AHE 605	ANIMAL HUSBANDRY PROGRAMME PLANNING AND EVALUATION	2+1
AHE 606	RESEARCH METHODOLOGY IN VETERINARY AND ANIMAL HUSBANDRY EXTENSION	2+1
AHE 607	SOCIAL PSYCHOLOGY AND GROUP DYNAMICS	2+1
AHE 608	ANIMAL HUSBANDRY DEVELOPMENT PROGRAMMES	1+0
AHE 609	DEVELOPMENTS IN THE CONCEPT OF EXTENSION	1+0
AHE 610	HUMAN RESOURCE MANAGEMENT IN ANIMAL HUSBANDRY SECTOR	2+1
AHE 611	GENDER AND LIVESTOCK DEVELOPMENT	1+0
AHE 612	INFORMATION AND COMMUNICATION TECHNOLOGY IN LIVESTOCK DEVELOPMENT	1+1
AHE 691	MASTER'S SEMINAR	1+0
AHE 699	MASTER'S RESEARCH	20
AHE 701	ORGANIZATIONAL MANAGEMENT	3+0
AHE 702	FARM JOURNALISM AND PUBLIC RELATIONS	2+1
AHE 703	ADVANCED RESEARCH TECHNIQUES IN SOCIAL RESEARCH	3+1
AHE 704	TRAINING FOR HUMAN RESOURCE DEVELOPMENT	2+1
AHE 705	POLICIES AND REGULATIONS IN LIVESTOCK SECTOR	2+0
AHE 706	EDUCATIONAL TECHNOLOGY	2+1
AHE 707	DYNAMICS OF CHANGE	2+0
AHE 708	ORGANIZATIONAL COMMUNICATION	2+1
AHE 790	SPECIAL PROBLEM	0+2
AHE 791	DOCTORAL SEMINAR I	1+0
AHE 792	DOCTORAL SEMINAR II	1+0
AHE 799	DOCTORAL RESEARCH	45

VETERINARY AND ANIMAL HUSBANDRY EXTENSION

Course Contents

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 non-adoption of various practices. Reasons for adoption and non-adoption of innovations

Suggested Readings

Brown Lawrence A. 1981. *Innovation Diffusion: A New Perspective*. Methuen.

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

Rogers EM. 2003. *Diffusion of Innovations*. Free Press.

Servaes J, Thomas LJ & 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 METHODOLOGY 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 non-experimental research. Variables, types and their measurement. Selection and formulation of research problem. Hypothesis– importance, selection criteria (quality of workable hypothesis), formulation and testing of hypothesis.

UNIT II

Measurement and levels of measurement; Research designs- exploratory, experimental, and ex-post-facto research design. Action research. Sampling methods-probability and non-probability sampling. Sources of errors.

UNIT III

Methods of data collection– survey method, observation method, interview/questionnaire method, case study, content analysis, sociometry and projective techniques. Action research. Reliability and validity of measurements.

UNIT IV

Social statistics – Parametric and non-parametric. Data processing and analysis. Report writing. Review of studies in social research.

Practical

Selecting a research problem and working it out with all the steps; report writing and presentation of the report.

Suggested Readings

Arlene Fink (Ed). 2003. *The Survey Kit* (10 booklets). Sage Publ.

Creswell John W. 1994. *Research Design – Qualitative and Quantitative Approaches*. University of Nebraska, Lincoln.

Edwards AL. 1969. *Techniques of Attitude Scale Construction*. Vakil, Feffer & Simons

Garrett HE. 1966. *Statistics in Psychology and Education*. International Book Bureau, Hyderabad.

Goode WJ & Hatt PK. 1952. *Methods in Social Research*. McGraw-Hill.

Guilford JP. 1971. *Psychometric Methods*. TATA McGraw Hill.
Henerson EM, Morris LL. & Gibbon CT. 1987. *How to Measure Attitudes*. Sage Publ.
Kerlinger FN. 1994. *Foundations of Behavioural Researches*. Holt, Rinehart & Winstons.
Kumar, R. 1999. *Research Methodology – A Step by Step for Beginners*. Sage Publ.
Miller Delbert C. 1991. *Handbook of Research Design and Social Measurement*. Indiana University. Sage Publ.
Oppenheim AN. 1979. *Questionnaire Design and Attitude Measurement*. Heinemann Educational Books.

AHE 607 SOCIAL PSYCHOLOGY AND GROUP DYNAMICS 2+1

Objective

To acquaint the students with the structure and functioning of social groups and socio-psychological aspects in interacting with livestock farmers.

Theory

UNIT I

Meaning, scope and importance of psychology in animal husbandry extension work. Orientation of psychology.

UNIT II

Perception- nature, laws and selectivity in perception, factors in perception, importance of perception in extension work. Attitude- nature, theories, measurement and change of attitude towards livestock owners, formation of stereo types and prejudice, factors in attitude change.

UNIT III

Motivation– nature, characteristics, theories, types and techniques of motivating farm people. Emotion- nature, types of emotional response, theories and role of emotion in regulating the human behaviour. Learning- principles, theories of learning and experiential learning.

UNIT IV

Intelligence- nature, theories and measurement. Personality- nature, traits, types, biological and socio-cultural determinants of personality. Group and individual behaviour.

UNIT V

Concept and types of groups; Typology and importance in rural development; Group structures - attraction, coalition, communication and power; Processes in group development and group identity; Factors affecting group performance; Conflicts in groups; Group belongingness.

Practical

Study of structure and functioning of selected Self Help Groups (SHGs), factors influencing the success/ failure of SHGs, Milk Cooperative Societies.

Suggested Readings

Baron RA. 1995. *Psychology*. Prentice Hall.
Cragan, FJ & Wright WD. 1999. *Communication in Small Groups – Theory, Process, Skills*. Wadsworth Publ.
Kagan J & Havemann E. 1980. *Psychology – An Introduction*. Harcourt Brace Javanovich Inc.

Morgan CT, King RA & Robinson NM. 1979. *Introduction to Psychology*. Tata McGraw-Hill.
Napier RW & Gershenfeld MK. 2006. *Groups – Theory and Experience*. AITBS Publ.
Secord PF & Backman CW. 1964. *Social Psychology*. McGraw-Hill.

AHE 608 ANIMAL HUSBANDRY DEVELOPMENT PROGRAMMES 1+0

Objective

To make the students aware of livestock development programmes launched by various agencies.

Theory

UNIT I

Concept of development, social and economic development; Historical overview on Rural Development in India

UNIT II

Ongoing Animal Husbandry Development Programmes - NPCBB, PM assistance livestock development programme, rural development programmes with special reference to livestock- SGSY, EGS

UNIT III

Transfer of Technology (TOT) programmes of ICAR– National Demonstration, Krishi Vigyan Kendra, Trainers' Training Centres, Lab to Land Programme, Operational Research Project, National Agricultural Research Project, Agricultural Technology Management Agency, National Agricultural Innovative Project.

UNIT IV

Understanding the functioning of livestock development institutions - DRDA, NABARD, Insurance Companies, NGOs.

Suggested Readings

Candler W & Kumar N. 1998. *India. The Dairy Revolution – The Impact of Dairy Development in India and the World Bank Contribution*. The World Bank.
Dahama OP & Bhatnagar OP. 1987. *Education and Communication for Development*. Oxford & IBH.
Govt. of India 2005. *A Reference Manual*. Ministry of Information and Broadcasting, New Delhi. http:/www.dahd.nic.in
Mathialagan P. 2005. Text Book of Animal Husbandry and Livestock Extension. *International Book Distributing Co*.
Ray GL. 1991. *Extension, Communication and Management*. Naya Prokash.

AHE 609 DEVELOPMENTS IN THE CONCEPT OF EXTENSION 1+0

Objective

To acquaint the students with the recent development in extension.

Theory

UNIT I

Important concepts in extension science; various schools of thought; Systems concept in extension.

UNIT II

Changing approaches – Farmer participatory approaches; Global concepts of extension as applied to Indian Context.

UNIT III

Recent trends in extension. Privatisation of extension. Public Private Partnership. Contract farming. Organic animal husbandry. Indicators of livestock sustainability. Animal welfare programmes

UNIT IV

Various stake holders in Livestock development; stakeholder analysis, problem tree

Suggested Readings

Blackburn DJ. 1989. *Foundations and Changing Practices in Extension*. Univ. of Guelph, Canada.

Jones GE. (Ed). 1985. *Investing in Rural Extension: Strategies and Goals*. Elsevier.

Roling N. 1988. *Extension Science*. Cambridge Univ. Press.

AHE 610 HUMAN RESOURCE MANAGEMENT IN ANIMAL HUSBANDRY SECTOR 2+1

Objective

To expose the students in human resource management techniques and dealing with the hierarchical and organizational problems.

Theory

UNIT I

Concept, importance and functions of human resource management. Process of management- planning, organizing, staffing, directing, coordination, reporting and budgeting. Principles, levels and types of organization.

UNIT II

Training– models, methods, identification of training needs, training evaluation and developing strategies for human resource development in animal husbandry sector.

UNIT III

Supervision- meaning, process and techniques. Work motivation. job efficiency and job satisfaction.

UNIT IV

Organizational communication. Organizational climate. Conflict management.

UNIT V

Personnel management in animal husbandry organizations and disaster management.

Practical

Training needs assessment, development of training module, organization, evaluation of a training programme

Suggested Readings

Buford JA, Bedeian AG & Lindner JR. 1995. *Management in Extension*. Ohio State Univ., USA.

Dwivedi RS. 1979. *Human Relations and Organizational Behaviour – A Global Perspective*. 5th Ed. McMillan India.

Keith D. 2004. *Human Behaviour*. 8th Ed. Mc Graw Hill.

Lynton R & Pareek U. 1990. *Training for Development*. Vistar Publ.

Lynton R & Pareek U. 2000. *Training for Organizational Transformation*. Sage Publ.

Mishra DC. 1990. *New Directions in Extension Training*. Directorate of Extension, Ministry of Agriculture, Govt. of India, New Delhi.
Stoner JAF & Freeman RF. 1994. *Management*. 5th Ed. Prentice Hall.
Turban E & Meredith J. 1991. *Fundamentals of Management Science*. 5th Ed. Home Wood I.L. Irwin.
Weirich H & Koontz H. 1993. *Management – A Global Perspective*. McGraw-Hill.

AHE 611 GENDER AND LIVESTOCK DEVELOPMENT 1+ 0

Objective

To acquaint the students with the concept of gender, its importance in livestock development, livestock development polices 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*. Sage Publ.

AHE 701 ORGANIZATIONAL MANAGEMENT 3+0

Objective

To acquaint the students with the general administration, management and motivational techniques for organizational change and development.

Theory

UNIT I

Concept, approaches and functions of management. Principles and process of organization, hierarchy of organization, departmentalisation. Authority and responsibility. Components of individual behaviour in organization. Organizational climate, decision making by consensus and participation by subordinates.

UNIT II

Motivation- nature and significance, motivational process, theories of motivation with respect to animal husbandry work. Importance of human needs, priority of needs, Managing work motivation.

UNIT III

Conflict – types and management. Leadership and its role in conflict resolution. Morale in organizations, organizational factors affecting morale, attitude, and productivity, methods of improving morale and evaluation of morale. Performance appraisal process.

UNIT IV

Supervision– principles, techniques and functions of supervision. Qualities of supervisor, supervisor-subordinate relationship and interaction process. Changing organizational structure and system, changing organizational climate and interpersonal style, issues and choice involved in making organizational climate.

UNIT V

Organization development– history, nature, characteristics, assumptions and process. Organization development interventions.

Suggested Readings

Selected articles from journals.

AHE 702 FARM JOURNALISM AND PUBLIC RELATIONS 2+1

Objective

To sensitize students about the role of mass media, news papers, magazines, radio, T.V. and internet for promoting animal husbandry.

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

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 and farm magazines.

UNIT III

Methods and techniques of broadcasting of farm programmes. Writing scripts for radio and televisions. Importance of public relations in veterinary and animal husbandry extension.

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. Relations with press media.

UNIT V

Event management, Organization of press meet. Qualities of a good public relation manager. Writing for press news.

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 and T.V. scripts. Visit to agricultural information and communication centre to record the activities of preparation, editing and publication of news articles and research publications. Exercise on the art of good speaking in class-room and field situations.

Suggested Readings

Selected articles from journals.

AHE 703 ADVANCED RESEARCH TECHNIQUES IN SOCIAL RESEARCH 3+1

Objective

To train the students about various research and management techniques/ methods applicable to animal husbandry researches.

Theory

UNIT I

Measurement– meaning and levels, tests, and scales. Different types of Variables.

UNIT II

Techniques of attitude scale construction viz. paired comparison, equal appearing interval, successive interval, summated ratings, scalogram analysis.

UNIT III

Measurement of reliability and validity of tests and scales. Sociometry. Critical incidence techniques. Q – sort technique, observation techniques, case studies.

UNIT IV

Experimental and quasi experimental research designs. Content analysis and projective techniques.

UNIT V

Multivariate analysis, systems analysis, principle component analysis, discriminant analysis and their application in extension education research.

Practical

Exercises on scaling techniques, attitude scale construction – Paired Comparison, Equal Appearing interval, Summated Rating Scale, Critical Incident Technique, Knowledge Test.

Suggested Readings

Selected articles from journals.

AHE 704 TRAINING FOR HUMAN RESOURCE DEVELOPMENT 2+1

Objective

To make the students aware of planning, implementation and evaluation of various training programmes.

Theory

UNIT I

Concept of training and education. Training infrastructure for extension personnel and farmers in India. Role of institution, organization and participants in success of training programme.

UNIT II

Assessment of training needs, curriculum design and development. Training strategies, models of training.

UNIT III

Planning, development and execution of training programmes.

UNIT IV

Training methods– Lecture, symposium, workshop, case studies, group discussion, conference, convention, panel discussion, buzz session, forum, debates, syndicate, simulation exercises, role playing, brain storming.

UNIT V

Evaluation and follow-up of training programmes.

Practical

Preparation of training programmes for extension personnel, livestock and poultry farmers. Evaluation of on-going training programmes.

Suggested Readings

Selected articles from journals.

AHE 705 POLICIES AND REGULATIONS IN LIVESTOCK SECTOR 2+0

Objective

To sensitize the students about policies and regulations in animal husbandry sector.

Theory

UNIT I

World Trade Organization in relation to livestock sector. Impact of WTO on Indian international trade of food products of animal origin, Intellectual Property Rights in relation to animal husbandry.

UNIT II

HACCP, Sanitary and phyto-sanitary measures to protect the animals' life and health, food safety uses in relation to animal husbandry sector. Introduction to Agreement on Technical Barriers to Trade (ATBT).

UNIT III

Animal welfare laws- legislations in veterinary and animal sciences.

UNIT IV

Prevention of Cruelty to Animals Act-1960 and Rules. Animal Welfare Board, ABC Programme. Acts related to animals and animal diseases. Animal quarantine and certification.

Suggested Readings

Selected articles from journals.

AHE 706 EDUCATIONAL TECHNOLOGY 2+1

Objective

To acquaint students with different concepts of education technology and preparation of teaching aids

Theory

UNIT I

Educational Technology – Meaning, concepts and components. Curriculum development at macro and micro levels. Formulation of instructional objectives.

UNIT II

Preparation of course outline for instructions, lesson planning. Designing instructions for theory and practical, Instructional methods and devices in class room instruction, computer aided learning. Understanding learners' behavior, learning styles, motivating learners.

UNIT III

Student counselling and guidance, Student evaluation – meaning and methods, construction of measuring instrument – question banking.

UNIT IV

Performance appraisal of teachers –meaning and methods, construction of assessment instruments. Use of library for effective learning.

Practical

Preparation of course outline, Preparation of lesson plans, Planning and preparation of instructional aids, Individual classroom instructional exercises, Development of student evaluation instrument, Development of performance appraisal instrument for teachers.

Suggested Readings

Selected articles from journals.

AHE 707 DYNAMICS OF CHANGE 2+0

Objective

To make the students aware of dynamics of change, group dynamics and social change.

Theory

UNIT I

Definition of change, development, social and cultural change. Dimensions, characteristics, types, rate and directions of social change. General conditions of social change.

UNIT II

Process of change. Concept, importance and problems of planned change. Role of change agents. Approaches of change agents towards planned change. Acceptance and rejection to planned change in animal husbandry. Techniques for accelerating change.

UNIT III

Theories of change: Darwin, Kurt, Lewin, Ogburn & influence process of change, assessment of resources, fixation of change objective, evaluating change effect. Barrier to change- psychological, social & economical, stimulants to change: psychological, social & economical.

UNIT IV

Agrarian changes with reference to livestock development.

Suggested Readings

Selected articles from journals.

AHE 708 ORGANIZATIONAL COMMUNICATION 2+1

Objective

To sensitize the students towards communication and networking to increase the efficiency of an organization.

Theory

UNIT I

Organizational communication– its importance, function and characteristics. Understanding of organizational communication. Types of organizational communication– upward, downward, diagonal and grapevine. Communication network.

UNIT II

Effectiveness and efficiency of organizational communication.

UNIT III

Essentials of a sound organizational communication system. Social and Psychological barriers to effective organization communication. Causes of poor organization communication.

Practical

Studies on organizational communication patterns in animal husbandry

Suggested Readings

Selected articles from journals.

AHE 790 SPECIAL PROBLEM 0+2

Objective

To provide expertise in handling practical research problem(s).

Practical

Short research problem(s) involving contemporary issues and research techniques.

VETERINARY AND ANIMAL HUSBANDRY EXTENSION

List of Journals

* Communicator
* Development communication
* Indian Dairyman
* Indian journal of Adult Education
* Indian Journal of Dairy Science
* Indian Journal of Extension Education
* Indian Journal of Psychology
* Indian Journal of Public Administration
* Journal of Dairy Research
* Journal of Extension Systems
* Journal of Rural Development
* Journal of Training and Development
* The Indian Journal of Animal Sciences
* The Indian Veterinary Journal
* Journal of Agriculture Extension and Education
* Indian Journal of Animal Research
* Indian Journal of Gender of Studies
* Kurukshetra
* Yojana
* Economic and Political weekly
* Indian Farming

e-Resources

* www.informaworld.com (Journal of Agricultural Education and Extension)
* www.blackwellpubllishing.co (International Journal of Training & Development)
* www.blackwellpubllishing.co Educational Measurement: Issue and Practices
* www.academicjournals.net (International Journal of Dairy Science)
* www. cipav.org.co (Livestock Research for Rural Development)
* www.joe.org Journal of Extension

Suggested Broad Topics for Master's and Doctoral Research

* Veterinary Education
* Training
* Communication and development
* Diffusion and adoption
* Management and entrepreneurship
* Livestock economics
* Evaluation of animal husbandry programmes

VETERINARY BIOCHEMISTRY

Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
VBC 601	CHEMISTRY OF ANIMAL CELL	2+0
VBC 602	TECHNIQUES IN BIOCHEMISTRY	0+2
VBC 603	APPLICATIONS OF GENOMICS AND PROTEOMICS IN MOLECULAR BIOLOGY	2+0
VBC 604	BIOCHEMISTRY OF BIOMOLECULES: CARBOHYDRATES, LIPIDS AND MEMBRANE'S STRUCTURE	2+0
VBC 605	ENZYME CATALYSIS, KINETICS, INHIBITION AND REGULATION	2+0
VBC 606	METABOLISM-I: CARBOHYDRATES AND LIPIDS	2+0
VBC 607	METABOLISM-II: NUCLEIC ACIDS AND AMINO ACIDS	2+0
VBC 608	METABOLISM-III: INTEGRATION AND REGULATION.	2+0
VBC 609	CENTRAL DOGMA AND PROTEIN FUNCTION	2+0
VBC 610	CLINICAL BIOCHEMISTRY OF ANIMALS	2+1
VBC 611	BIOCHEMICAL BASIS OF DISEASES OF DOMESTIC ANIMALS	2+0
VBC 612	ENDOCRINOLOGY AND REPRODUCTIVE BIOCHEMISTRY	2+0
VBC 613	BIOCHEMICAL BASIS OF ANIMAL PRODUCTION	2+1
VBC 691	MASTER'S SEMINAR	1+0
VBC 699	MASTER'S RESEARCH	20
VBC 701	ADVANCES IN BIOCHEMISTRY OF RUMINANT DISORDERS	2+0
VBC 702	ADVANCES IN ENZYMOLOGY	2+0
VBC 703	ADVANCES IN CLINICAL BIOCHEMISTRY	0+2
VBC 704	MEMBRANE DYNAMICS AND SIGNAL TRANSDUCTION IN ANIMAL CELL	2+0
VBC 705	METHODS IN PROTEIN ANALYSIS	2+1
VBC 706	NUTRITIONAL BIOCHEMISTRY	2+0
VBC 707	ADVANCES IN INTERMEDIARY METABOLISM	2+0
VBC 708	ENDOCRINE CONTROL OF FUEL METABOLISM	2+0
VBC 709	DIAGNOSTIC ENZYMOLOGY-I	2+0
VBC 710	DIAGNOSTIC ENZYMOLOGY-II	2+0
VBC 711	BIOCHEMISTRY OF DEVELOPMENT AND DIFFERENTIATION	2+0
VBC 712	ADVANCES IN TECHNIQUES IN BIOCHEMISTRY	1+1
VBC 713	ADVANCES IN MINERAL AND VITAMIN METABOLISM AND RELATED DISEASES	2+0
VBC 790	SPECIAL PROBLEM	0+2
VBC 791	DOCTORAL SEMINAR I	1+0
VBC 792	DOCTORAL SEMINAR II	1+0
VBC 799	DOCTORAL RESEARCH	45

VETERINARY BIOCHEMISTRY

Course Contents

VBC 601 CHEMISTRY OF ANIMAL CELL 2+0

Objective

Teaching of principles of physical chemistry as applicable to veterinary sciences.

Theory

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. ΔG 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. ΔG, ATP and phosphoryl group transfer, coupled reactions, thioesters, NAD+ and FAD.

UNIT II

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

UNIT III

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

UNIT IV

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

Suggested Readings

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

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 Press.

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

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

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

Objective

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

Theory

UNIT I

Regulation and integration of all metabolic pathways.

UNIT II

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

UNIT III

Signal transduction, gated ion channels, G-proteins, adenylate cyclase, receptor tyrosine kinase, protein phosphatases, cGMP, 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 Press.

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

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

VBC 609 CENTRAL DOGMA AND PROTEIN FUNCTION 2+0

Objective

Teaching of applied aspects of replication, transcription and translation.

Theory

UNIT I

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

UNIT II

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

UNIT III

Actin structure, microfilament dynamics, actin-myosin reacting cycle, tubulin 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.

VBC 701 ADVANCES IN BIOCHEMISTRY OF RUMINANT DISORDERS 2+0

Objective

To give exposure about biochemical changes in diseases of ruminants.

Theory

UNIT I

Comparative ruminant metabolism, metabolism of various nutrients by microflora. Postruminal digestion of dietary and microbial biomolecules.

UNIT II

Metabolic disorders of rumen and recent development in disorders of ruminants associated with protein, carbohydrate and fat metabolism.

UNIT III

Recent development in disorders of ruminants associated with mineral and electrolyte metabolism.

Suggested Readings

Selected articles from journals.

VBC 702 ADVANCES IN ENZYMOLOGY 2+0

Objective

To teach current developments in actions of enzymes.

Theory

UNIT I

Current concept on how enzymes work.

UNIT II

Recent innovations in enzymes kinetics to understand mechanism.

UNIT III

Current topics on regulatory enzymes.

UNIT IV

Lysozymes, serine proteases, drug design.

Suggested Readings

Selected articles from journals.

VBC 703 ADVANCES IN CLINICAL BIOCHEMISTRY 0+2

Objective

To educate students about current developments in clinical biochemistry.

Theory

UNIT I

Scope of clinical biochemistry and its application in disease diagnosis.

UNIT II

Molecular basis of cell injury and diseases.

UNIT III

Molecular basis of autoimmunity, immunodeficiency, oncogenesis.

UNIT IV

Functional tests : DNA finger printing, micro and mini satellites, PCR-RFLP in clinical biochemistry, DNA microarrays. Biomolecular prospecting and molecular designing.

Practical

Nucleic acid extraction, protein arrays, RT-PCR, hybridization, electrophoretogram ad chromatogram of macromolecules.

Suggested Readings

Selected articles from journals.

VBC 704 MEMBRANE DYNAMICS AND SIGNAL TRANSDUCTION IN ANIMAL CELL 2+0

Objective

Discussions on recent developments in membrane function.

Theory

UNIT I

Developments in physical & chemical features of biological transport.

UNIT II

Developments in membrane dynamics.

UNIT III

Developments in solute transport across membrane.

UNIT IV

Developments in molecular mechanisms of signal transduction, regulation by steroid hormone, protein kinases.

UNIT V

Developments in signaling in microorganisms, special senses.

Suggested Readings

Selected articles from journals.

VBC 705 METHODS IN PROTEIN ANALYSIS 2+1

Objective

Discussions on contemporary information on techniques in protein research.

Theory

UNIT I

Separation, purification and characterization of proteins in ECF and membrane.

UNIT II

Subcellular organization of proteins fused with green fluorescent protein. High throughput methodologies for determining protein structure.

Investigating protein with mass spectrometry. Method of determining three dimensional structure of protein. Use of atomic force microscopy in visualizing protein complexes and membrane surfaces.

UNIT III

Use of FRET (fluorescence resonance energy transfer) to measure transient changes in second messenger or protein kinase activity in living cell. Proteomics.

Practical

Proteomics, protein quantification.

Suggested Readings

Selected articles from journals.

VBC 706 NUTRITIONAL BIOCHEMISTRY 2+0

Objective

To give exposure about biochemical principle as applicable to nutrition in animals and poultry.

Theory

UNIT I

Evolution of diet and nutritional status of animals, digestion, absorption in ruminants, equine and poultry.

UNIT II

Calorimetry, BMR, SDA, PER, nutritional need for growth, work, production and disease. Parental nutrition.

UNIT III

Obesity, food additives and naturally occurring toxic substances in food, dietary factors in carcinogenesis, free radical, antioxidant and pro-oxidant.

Suggested Readings

Selected articles from journals.

VBC 707 ADVANCES IN INTERMEDIARY METABOLISM 2+0

Objective

To teach methods and approaches in research on metabolism.

Theory

UNIT I

Energy transformation in living cell, enzymes system, high energy compounds.

UNIT II

Overview of cycles, role of TCA in producing biological precursor in evolution. Control of fatty acid metabolism, lipoprotein metabolism, pathways of amino acids, integration of cycles, metabolism of purines, pyrimidines. CoA, NAD^+, FAD and ATP.

UNIT III

Analytical approaches in studies on intermediary metabolism.

Suggested Readings

Selected articles from journals.

VBC 708 ENDOCRINE CONTROL OF FUEL METABOLISM 2+0

Objective

To study hormonal regulation and integration of mammalian metabolism.

Theory

UNIT I

Hormone: Diverse structure for diverse functions.

UNIT II

Tissue specific metabolism.

UNIT III

Hormonal regulation of fuel metabolism.

UNIT IV

Regulation of body mass, production of beef, egg, poultry and fish.

Suggested Readings

Selected articles from journals.

VBC 709 DIAGNOSTIC ENZYMOLOGY - I 2+0

Objective

To expose students about use of enzymes in diagnostics.

Theory

UNIT I

History, development, validation of clinical enzyme assay.

UNIT II

Assay of enzymes in clinical cases. Enzyme urea. Enzymes in pathogenesis.

UNIT III

Enzyme histochemistry and cytochemistry, immobilized enzymes. Enzyme immuno diagnostics, molecular genetics.

Suggested Readings

Selected articles from journals.

VBC 710 DIAGNOSTIC ENZYMOLOGY - II 2+0

Objective

To provide in-depth knowledge about enzymes in diagnosis of diseases of animals and poultry.

Theory

UNIT I

Phosphatases, creatine kinase in diagnosis of diseases of animals and poultry.

Unit.II

Amino transferases, trypsin in diagnosis of diseases of animals and poultry.

UNIT III

Dehydrogenases in diagnosis of diseases of animals and poultry.

Unit.IV

Cholinesterase, lipase, amylase, GGT, GTPx, arginase, AST, ALT & SDH in diagnosis of diseases of animals in poultry. Enzymes in pathogenesis.

Suggested Readings

Selected articles from journals.

VBC 711 BIOCHEMISTRY OF DEVELOPMENT AND DIFFERENTIATION 2+0

Objective

To develop understanding of biochemical basis of embryo development in mammals and aves.

Theory

UNIT I

Molecular basis of reproductive events including gametogenesis, fertilization, embryo development and differentiation, gene knock out

UNIT II

Homeotic gene maintenance and repair of body tissue.

UNIT III

Biochemical basis of chick and fetal development

Suggested Readings

Selected articles from journals.

VBC 712 ADVANCES IN TECHNIQUES IN BIOCHEMISTRY 0+2

Objective

To expose students about current developments in techniques used in animal biochemistry.

Practical

Tracer methodologies as applied to problems in biochemistry. Electrophoresis, HPLC, GLC & TLC, spectrometry as applied to problems in biochemistry. X-Ray-Crystallography, NMR Spectrometry. Atomic absorption spectrophotometry as applied to problems in biochemistry. Ultracentrifugation as applied to problems in biochemistry.

Suggested Readings

Selected articles from journals.

VBC 713 ADVANCES IN MINERAL AND VITAMIN METABOLISM AND RELATED DISEASES 2+0

Objective

To expose students to latest class material to be given on recent trends in research on cofactor and mineral metabolism disorders in animals.

Theory

UNIT I

Biochemical basis of conditions related to nutrient deficiency & excess

UNIT II

Metabolism of Ca, P, Mg, Na, K and the related diseases in animals and poultry.

UNIT III

Minerals and B Vitamins as cofactors and their metabolism in livestock and poultry.

UNIT IV

Biochemical mechanisms of fat soluble and water soluble vitamins and their metabolism in livestock and poultry.

Suggested Readings

Selected articles from journals.

VBC 790 SPECIAL PROBLEM 0+2

Objective

To provide expertise in handling practical research problem(s).

Practical

Short research problem(s) involving contemporary issues and research techniques.

VETERINARY BIOCHEMISTRY

List of Journals

* Indian Journal of Chemical Technology
* Indian Journal of Biochemistry and Biophysics
* Indian Journal of Chemistry - Section B
* Indian Veterinary Journal
* Journal of Chemical Sciences
* Journal of Indian Chemical Society
* Meat Science - An International Journal
* The EMBO Journal
* Theriogenology
* Trends in Biochemical Sciences

e-Resources

* www.niscair.res.in/ScienceCommunication (Indian Journal of Biochemistry)
* www.medind.nic.in/iaf/iafm.shtml (Indian Journal of Clinical Biochemistry)
* www.ijcb.co.in (Indian Journal of Clinical Biochemistry)
* www.mcponline.org (Molecular & Cellular Proteomics)
* www.elsevier.com/vj/proteomics (Proteomics Virtual Journal)
* www.elsevier.com (Journal of Proteomics)
* www.elsevier.com (Clinical Biochemistry)
* www.sciencedirect.com/science/journal (Science Direct –Clinical Biochemistry)
* www.jbc.org (Journal of Biological Chemistry)

Suggested Broad Topics for Master's and Doctoral Research

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

VETERINARY PHYSIOLOGY

Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
VPY 601	PHYSIOLOGY OF DIGESTION	2+1
VPY 602	CARDIOVASCULAR AND RESPIRATORY PHYSIOLOGY	2+1
VPY 603	RENAL PHYSIOLOGY AND BODY FLUID DYNAMICS	2+1
VPY 604	HAEMATOLOGY	2+1
VPY 605	VITAMINS AND MINERALS IN ANIMAL PHYSIOLOGY	2+0
VPY 606	PHYSIOLOGY OF ANIMAL REPRODUCTION	2+1
VPY 607	CLINICAL PHYSIOLOGY	2+1
VPY 608	NEUROMUSCULAR PHYSIOLOGY	2+1
VPY 609	CHEMICAL BIOREGULATION IN PHYSIOLOGICAL FUNCTIONS	3+0
VPY 610	RESEARCH TECHNIQUES IN VETERINARY PHYSIOLOGY	0+2
VPY 691	MASTER'S SEMINAR	1+0
VPY 699	MASTER'S RESEARCH	20
VPY 701	APPLIED PHYSIOLOGY OF BODY FLUIDS AND ELECTROLYTES	2+1
VPY 702	PHYSIOLOGY OF ANIMAL BEHAVIOUR	2+0
VPY 703	COMPARATIVE PHYSIOLOGY OF RUMINANT DIGESTION	2+1
VPY 704	ADVANCES IN NEURO-ENDOCRINOLOGY	2+1
VPY 705	MYOPHYSIOLOGY AND KINESIOLOGY	2+1
VPY 706	AVIAN PHYSIOLOGY	2+1
VPY 707	PHYSIOLOGY OF LACTATION	2+1
VPY 708	ADVANCES IN ENVIRONMENTAL PHYSIOLOGY AND GROWTH	2+1
VPY 709	ADVANCES IN RUMEN MICROBIOLOGY AND METABOLISM	2+1
VPY 710	ADVANCES IN IMMUNOPHYSIOLOGY	2+1
VPY 711	PHYSIOLOGY OF STRESS	2+1
VPY 790	SPECIAL PROBLEM	0+2
VPY 791	DOCTORAL RESEARCH I	1+0
VPY 792	DOCTORAL RESEARCH II	1+0
VPY 799	DOCTORAL RESEARCH	45

VETERINARY PHYSIOLOGY

Course Contents

VPY 601 PHYSIOLOGY OF DIGESTION 2+1

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

Rumen microbiology. Digestion in birds.

Practical

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

Suggested Readings

Cunningham JG. 1992. *Text book of Veterinary Physiology*. WB Saunders.

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

D.C. Church. (1988) *Digestive Physiology & Nutrition of Ruminants*. Praeice Hall.

Hungate R.E. 1966. *Rumen and its Microbes*. Acad. Press. N.Y.

Forbes JM. & France J. 1993. *Quantitative aspects of Ruminant Digestion & Metabolism*. CAB International. Cambridge. UK

VPY 602 CARDIOVASCULAR AND RESPIRATORY PHYSIOLOGY 2+1

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Practical

Determination and recording of cardiac output, blood pressure and electrocardiogram, blood volume. Estimation of lung volumes and capacities by 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.

VPY 701 APPLIED PHYSIOLOGY OF BODY FLUIDS AND ELECTROLYTES 2+1

Objective

To teach physiological and clinical implication of changes in electrolytes and body fluids.

Theory

UNIT I

Volume and composition of body fluids, exchange of water and electrolytes between body compartments, blood and external environment. Osmolarity of fluid.

UNIT II

Regulation of volume and osmolarity of extra cellular fluid. Regulation of pH and acid base balance. Formation and composition of cerebrospinal fluid and lymph.

UNIT III

Clinical implications of change in electrolytes and body fluids. Structural and functional consideration of plasma and its composition. Diuresis and endocrine control of renal functions.

UNIT IV

Clinical feature in fluid and electrolyte imbalance, clinicopathological indictors of fluid and electrolytes imbalance.

Practical

Determination of electrolytes viz. sodium, potassium and chloride in plasma, determination of total body water and plasma volume by various techniques i.e. dye dilution and radioisotope technique, Estimation of osmolarity and osmolality of body fluids.

Suggested Readings

Selected articles from journals.

VPY 702 PHYSIOLOGY OF ANIMAL BEHAVIOUR 2+0

Objective

To impart knowledge on various aspects of animal behaviour viz. communication in animals, sexual behaviour, feeding behaviour etc.

Theory

UNIT I

Introduction to animal ethology. Neurophysiological basis of animal behaviour.

UNIT II

Behaviour in relation to changes in the environment. Feeding behaviour, grazing, stall feeding and rumination.

UNIT III

Sexual behaviour in the female and male. Maternal behaviour. Milk let down.

UNIT IV

Social behaviour, communication in animals, animal temperament. Response of dogs and horses to training.

Suggested Readings

Selected articles from journals.

VPY 703 COMPARATIVE PHYSIOLOGY OF RUMINANT DIGESTION 2+1

Objective

To teach functional development of rumen and comparative digestive functions in different ruminant species.

Theory

UNIT I

Functional development of ruminant stomach. Rumen motility and its control.

UNIT II

Salivary secretion and its regulation. Intraruminal environment, rumen metabolites and their assimilation, NPN feeding, nitrogen recycling.

UNIT III

Synthesis of microbial proteins and vitamins. Rumen dysfunctions. Comparative efficiency of rumen function in different species. Stoichiometry of carbohydrate fermentation.

UNIT IV

Manipulation of rumen fermentation, protected nutrients feeding, probiotics supplementation etc. Rumen flow rate and rumen volume.

Practical

Reticulo-ruminal motility, artificial rumen techniques, total volatile fatty acids and their fractions, bacteria, protozoa and fungi in rumen. Flow rates of ruminal contents.

Suggested Readings

Selected articles from journals.

VPY 704 ADVANCES IN NEURO-ENDOCRINOLOGY 2+1

Objective

To acquaint the students about neuro-endocrine integrating mechanism in animals and birds.

Theory

UNIT I

Neuroendocrine integrating mechanism. Structure of hypothalamus, pituitary gland, limbic and other neural pathways and endocrine functions.

UNIT II

Neural control of oxytocin, adrenocorticotropic hormone, aldosterone, thyrotropic hormone, growth hormone, gonadotrophins etc. Hypothalamic releasing factors and the neuro-vascular link between brain and anterior pituitary.

UNIT III

Role of afferent impulses from genitals and other regions in reproductive system. Influence of hormones on brain activity.

UNIT IV

Effects of drugs on neuro-endocrine system. Neuro-endocrine mechanisms in birds. Interaction of nervous, endocrine and immune system in animal production and reproduction.

Practical

Radio-immuno assay of progesterone, effects of ovariectomy, effects of testosterone treatment. Bioassay of estrogens. Estimation of T_3 and T_4 in blood.

Suggested Readings

Selected articles from journals.

VPY 705 MYOPHYSIOLOGY AND KINESIOLOGY 2+1

Objective

To impart the knowledge regarding exercise and work physiology, molecular basis of muscle contraction.

Theory

UNIT I

Structure of muscle, chemical composition, muscle contraction and irritability. Mechanical properties of skeletal muscle.

UNIT II

Thermal properties of muscles. Chemical correlates of contraction.

UNIT III

Molecular basis of muscular contraction of skeletal muscle. Pathophysiology of muscles and myocardium.

UNIT IV

Lever systems of body joints, Synovial fluid formation and its physiology. Principles of Kinesiology and its application in work physiology.

Practical

Electromyogram, Tetany. Electro-cardiogram. Intestinal movements. Effects of various drugs on all types of muscles.

Suggested Readings

Selected articles from journals.

VPY 706 AVIAN PHYSIOLOGY 2+1

Objective

To impart complete knowledge about physiology of domestic fowl and comparative physiology of other birds.

Theory

UNIT I

Digestive and urinary system.

UNIT II

Blood, cardiovascular and respiratory system.

UNIT III

Reproductive and endocrine system.

UNIT IV

Nervous system and musculo-skeletal system.

Practical

Study of blood cells, haemoglobin, packed cell volume (haematocrit) and erythrocyte sedimentation rate. Determination of glucose, calcium, uric acid and urea in blood. Electrophoretic separation of plasma proteins and egg proteins.

Suggested Readings

Selected articles from journals.

VPY 707 PHYSIOLOGY OF LACTATION 2+1

Objective

To acquaint students with physiology and mechanism of lactation.

Theory

UNIT I

Functional anatomy, histology and cytology of mammary gland in domestic animals.

UNIT II

Development of mammary gland, hormonal control of mammary gland growth.

UNIT III

Process of lactation, initiation of milk secretion, hormonal control of lactation. Biochemical and histological changes in mammary gland during lactation. Mechanism of galactopoiesis.

UNIT IV

Neural control of lactation, milk let down, milk ejection and inhibition of milk ejection. Induced lactation. Composition of milk in different species of animals.

Practical

Examination of normal udder of cow and buffalo. Composition of colostrum and milk during different phases of lactation. Effect of adrenalin and oxytocin on milk let down, artificial induction of lactation. Estimation of lactogenic hormones.

Suggested Readings

Selected articles from journals.

VPY 708 ADVANCES IN ENVIRONMENTAL PHYSIOLOGY AND GROWTH 2+1

Objective

To acquaint the students about co-relation of various environmental factors on growth and performance of animals.

Theory

UNIT I

Ecology of farm animals, biological rhythms, mammalian circadian rhythms, their regulation. Components of physical environment, biometeorology and principles of thermoregulation in mammals and birds.

UNIT II

Physiological response of farm animals to heat and cold. Effect of various climatic components on health and production (growth and egg production), reproduction and climatic adaptation.

UNIT III

Concept and definitions of cellular, prenatal and postnatal growth- patterns in different species of domestic animals.

UNIT IV

Factors affecting live weight growth viz. nutrition, hormones, vitamins, antibiotics, environment. Ageing and senescence. Growth anomalies.

Practical

Growth measurement and growth curves, recording of various climatic variables, effect of climatic variables on growth and production.

Suggested Readings

Selected articles from journals.

VPY 709 ADVANCES IN RUMEN MICROBIOLOGY AND METABOLISM 2+1

Objective

Students will learn about rumen ecosystem and symbiotic relationship of flora and fauna, their structure and functions. Rumen manipulation techniques.

Theory

UNIT I

Introduction to rumen bacteria, protozoa and fungi. Development and natural fluctuation in rumen microbial population.

UNIT II

Microbial ecology and physiology of feed degradation within the rumen. Metabolism of nitrogen containing compounds.

UNIT III

Degradation of carbohydrate, fat and protein by rumen microbes, NPN utilization, Microbe-microbe interaction. Protected nutrients and other feed additives.

UNIT IV

Genetics and biotechnology of rumen microbes, rumen anaerobic fungi, their role and interaction with other rumen microbes.

Practical

Counting of total and differential protozoa, total and viable bacteria and fungi in rumen liquor. Individual VFA by GLC. Defaunation and manipulation of rumen fermentation. Culture of bacteria and fungi.

Suggested Readings

Selected articles from journals.

VPY 710 ADVANCES IN IMMUNOPHYSIOLOGY 2+1

Objective

To study cells and organs of immune system, its development and role in physiological functions and immunomodulation.

Theory

UNIT I

Introduction, history, body defense, organs of immune system, ontogeny and phylogeny of immune system, vertical transmission of immunity and difference between vertebrates and invertebrates

UNIT II

Immunoglobulins-basic structure and functions, hematopoiesis, T-cell and B-cell-evolution, development and their functions, species specific immunity, cytokines-sources and actions, MHC, genetic organization of immunoglobulin, MHC and complement system.

UNIT III

Immune-endocrine interactions, immune system in reproduction, ageing, stress and other physiological functions, immunomodulation.

UNIT IV

Hypersensitivity, diseases related to immune system, dysfunction, autoimmune disorders and their genesis, immunodeficiency.

Practical

Qualitative & quantitative analysis of immunoglobulins in body fluids, RIA, ELISA, Electrophoresis techniques in immunophysiology, raising hyperimmune sera and blood group immunophysiology.

Suggested Readings

Abbas AK, Lichtman AH & Pillai S. (Eds). 2007. *Cellular and Molecular Immunology*. 6th Ed. Elsevier.

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

Roitt IM. 1997. *Essential Immunology*. 9th Ed. Blackwell, Oxford.

Tizzard IR. 2004. *Veterinary Immunology*. 5th Ed. WB. Saunders.

VPY 711 PHYSIOLOGY OF STRESS 2+1

Objective

To teach the mechanism and effect of stress on production and reproduction in domestic animals.

Theory

UNIT I

Definition of stress, various types of stresses, their effect on animal production and reproduction.

UNIT II

Physico-chemical changes of blood composition due to exercise and work. Energy utilization and requirement of muscles during work and exercise.

UNIT III

Capacity of work under field and controlled laboratory conditions, factors that regulate it.

UNIT IV

Effect of various stresses on endocrine status of animals, endurances in animals.

Practical

Measurement of various biochemical parameters during stress and /or exercise in animals, measurement of various hormones during different stresses in animals, measurement of cardio-respiratory reactions during stresses.

Suggested Readings

Selected articles from journals.

VPY 790 SPECIAL PROBLEM 0+2

Objective

To provide expertise in handling practical research problem(s).

Practical

Short research problem(s) involving contemporary issues and research techniques.

VETERINARY PHYSIOLOGY

List of Journals

* Acta Endocrinologica
* Advances in Clinical Chemistry
* Advances in Reproductive Physiology
* Advances in Veterinary Sciences
* American Journal of Clinical Nutrition
* American Journal of Physiology
* American Journal of Veterinary Research
* Animal Nutrition and Feed Technology
* Animal Reproduction Science
* Animal Sciences
* Annual Review of Physiology
* Buffalo Journal
* Domestic Animal Endocrinology
* Indian Journal of Animal Reproduction
* Indian Journal of Animal Nutrition
* Indian Journal of Animal Physiology
* Indian Journal of Animal Research
* Indian Journal of Animal Science
* Indian Veterinary Journal
* Journal of Endocrinology
* Journal of Physiology
* Journal of Reproduction and Fertility
* Neuroendocrinology

e-Resources

* http://intl-joe, endocrinology-journals.org (Journal of Endocrinology)
* http://intl-ajpcon.physiology.org (American Journal of Physiology)
* http://arjournals.annualreviewes.org (Annual Review of Physiology)
* www.jneurosci.org (Journal of Neuroscience)
* www3.interscience.wiley.com (Journal of Physiology & Animal Nutrition)
* http://jp.physioc.org. (Journal of Physiology)

Suggested Broad Topics for Master's and Doctoral Research

* Manipulation of rumen fermentation to enhance growth and productivity in ruminants.

* Normal renal functions of domestic animals.

* To study the mechanism of regulation of various hormones involved in production and reproduction in domestic animals.

* Dietary effects on growth and production in poultry.

COMPULSORY NON-CREDIT COURSES

(Compulsory for Master's programme in all disciplines; Optional for Ph.D. scholars)

CODE	COURSE TITLE	CREDITS
PGS 501	LIBRARY AND INFORMATION SERVICES	0+1
PGS 502	TECHNICAL WRITING AND COMMUNICATIONS SKILLS	0+1
PGS 503 (e-Course)	INTELLECTUAL PROPERTY AND ITS MANAGEMENT	1+0
PGS 506 (e-Course)	DISASTER MANAGEMENT	1+0

Course Contents

PGS 501 LIBRARY AND INFORMATION SERVICES 0+1

Objective

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

Practical

Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-resources access methods.

PGS 502 TECHNICAL WRITING AND COMMUNICATIONS SKILLS 0+1

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc.

To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical

Technical Writing - Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination, numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article.

Communication Skills **-** Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.

Suggested Readings

Chicago Manual of Style. 14th Ed. 1996. Prentice Hall of India.

Collins' Cobuild English Dictionary. 1995. Harper Collins.

Gordon HM & Walter JA. 1970. *Technical Writing*. 3rd Ed. Holt, Rinehart & Winston.

Hornby AS. 2000. *Comp. Oxford Advanced Learner's Dictionary of Current English*. 6th Ed. Oxford University Press.

James HS. 1994. *Handbook for Technical Writing*. NTC Business Books.

Joseph G. 2000. *MLA Handbook for Writers of Research Papers*. 5th Ed. Affiliated East-West Press.

Mohan K. 2005. *Speaking English Effectively*. MacMillan India.

Richard WS. 1969. *Technical Writing*. Barnes & Noble.

Robert C. (Ed.). 2005. *Spoken English: Flourish Your Language*. Abhishek.

Sethi J & Dhamija PV. 2004. *Course in Phonetics and Spoken English*. 2nd Ed. Prentice Hall of India.

Wren PC & Martin H. 2006. *High School English Grammar and Composition*. S. Chand & Co.

PGS 503 (e-Course) **INTELLECTUAL PROPERTY AND ITS MANAGEMENT** **1+0**

Objective

The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Theory

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of animal varieties and farmers' rights and bio-diversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

Suggested Readings

Erbisch FH & Maredia K.1998. *Intellectual Property Rights in Agricultural Biotechnology*. CABI.

Ganguli P. 2001. *Intellectual Property Rights: Unleashing Knowledge Economy*. McGraw-Hill.

Intellectual Property Rights: Key to New Wealth Generation. 2001. NRDC & Aesthetic Technologies.

Ministry of Agriculture, Government of India. 2004. *State of Indian Farmer*. Vol. V. *Technology Generation and IPR Issues*. Academic Foundation.

Rothschild M & Scott N. (Ed.). 2003. *Intellectual Property Rights in Animal Breeding and Genetics*. CABI.

Saha R. (Ed.). 2006. *Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies*. Daya Publ. House.

The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.

PGS 506 DISASTER MANAGEMENT 1+0
(e-Course)

Objectives

To introduce learners to the key concepts and practices of natural disaster management; to equip them to conduct thorough assessment of hazards, and risks vulnerability; and capacity building.

Theory

UNIT I

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depletion

UNIT II

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, Industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

UNIT III

Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.

Suggested Readings

Gupta HK. 2003. *Disaster Management*. Indian National Science Academy. Orient Blackswan.

Hodgkinson PE & Stewart M. 1991. *Coping with Catastrophe: A Handbook of Disaster Management*. Routledge.

Sharma VK. 2001. *Disaster Management*. National Centre for Disaster Management, India.