Basic Veterinary Subjects

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

<table>
<thead>
<tr>
<th>Section</th>
<th>Page(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Executive Summary</td>
<td>3-5</td>
</tr>
<tr>
<td>BSMAC Composition</td>
<td>6</td>
</tr>
<tr>
<td>Preamble</td>
<td>7-9</td>
</tr>
<tr>
<td>Organization of Course Contents &amp; Credit Requirements</td>
<td>10-11</td>
</tr>
<tr>
<td>Veterinary Anatomy and Histology</td>
<td>12-22</td>
</tr>
<tr>
<td>Course Structure – at a Glance</td>
<td>12</td>
</tr>
<tr>
<td>Course Contents</td>
<td>13</td>
</tr>
<tr>
<td>List of Journals</td>
<td>22</td>
</tr>
<tr>
<td>e-Resources</td>
<td>22</td>
</tr>
<tr>
<td>Suggested broad Topics for Master’s and Doctoral Research</td>
<td>22</td>
</tr>
<tr>
<td>Veterinary and Animal Husbandry Extension</td>
<td>23-38</td>
</tr>
<tr>
<td>Course Structure – at a Glance</td>
<td>23</td>
</tr>
<tr>
<td>Course Contents</td>
<td>24</td>
</tr>
<tr>
<td>List of Journals</td>
<td>38</td>
</tr>
<tr>
<td>e-Resources</td>
<td>38</td>
</tr>
<tr>
<td>Suggested broad Topics for Master’s and Doctoral Research</td>
<td>38</td>
</tr>
<tr>
<td>Veterinary Biochemistry</td>
<td>39-53</td>
</tr>
<tr>
<td>Course Structure – at a Glance</td>
<td>39</td>
</tr>
<tr>
<td>Course Contents</td>
<td>40</td>
</tr>
<tr>
<td>List of Journals</td>
<td>53</td>
</tr>
<tr>
<td>e-Resources</td>
<td>53</td>
</tr>
<tr>
<td>Suggested broad Topics for Master’s and Doctoral Research</td>
<td>53</td>
</tr>
<tr>
<td>Veterinary Physiology</td>
<td>54-68</td>
</tr>
<tr>
<td>Course Structure – at a Glance</td>
<td>54</td>
</tr>
<tr>
<td>Course contents</td>
<td>55</td>
</tr>
<tr>
<td>List of Journals</td>
<td>68</td>
</tr>
<tr>
<td>e-Resources</td>
<td>68</td>
</tr>
<tr>
<td>Suggested broad Topics for Master’s and Doctoral Research</td>
<td>68</td>
</tr>
<tr>
<td>Compulsory Non credit courses</td>
<td>69-71</td>
</tr>
</tbody>
</table>
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 biomechanics 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 wherever 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)

<table>
<thead>
<tr>
<th>Name</th>
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</thead>
<tbody>
<tr>
<td>Dr. Dharmeshwar Das</td>
<td>IVRI, Izatnagar</td>
<td>Genetics</td>
</tr>
<tr>
<td>Convenor</td>
<td></td>
<td></td>
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<tr>
<td>Dr. V. K. Kansal</td>
<td>Animal Biochemistry Division, NDRI, Karnal</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>Head</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dr. S. D. Singh</td>
<td>CIFE, Mumbai</td>
<td></td>
</tr>
<tr>
<td>Prof. &amp; Head</td>
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<td></td>
</tr>
<tr>
<td>Dr. Geetha Ramesh</td>
<td>Dept. of Vety. Anatomy &amp; Histology, Madras Vety. College, Chennai</td>
<td>Anatomy &amp; Histology</td>
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<tr>
<td>Prof. &amp; Head</td>
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<tr>
<td>Dr. S. K. Rastogi</td>
<td>Dept. of Vety. Physiology, GBPUAT, Pantnagar</td>
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<tr>
<td>Dr. S.V.N. Rao</td>
<td>Dept. of VAHE, Rajiv Gandhi College of Vety. &amp; Animal Sciences, Podicherry</td>
<td>Extension</td>
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<tr>
<td>Prof. &amp; Head</td>
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<tr>
<td>Dr. Rajesh Nigam</td>
<td>Dept. of Vety. Biochemistry, Vety. College, Mathura</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>Registrar</td>
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</tr>
<tr>
<td>Dr. J. S. Bhatia</td>
<td>Dept of Vety. Physiology, Appolo College of Vety. Medicine, Jaipur</td>
<td>Physiology</td>
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<tr>
<td>Prof. &amp; Head</td>
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<tr>
<td>Dr. S.K. Nagpal</td>
<td>College of Vety. Sciences, CCS HAU Hisar</td>
<td>Anatomy</td>
</tr>
<tr>
<td>Dean</td>
<td></td>
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<tr>
<td>Member Secretary</td>
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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 1Basic Veterinary Sciences (Anatomy and Histology; Veterinary & Animal Husbandry Extension; Biochemistry and Physiology); 2Veterinary Para-clinical Sciences (Microbiology, Parasitology, Pathology, Pharmacology & Toxicology, Public Health) and 3Veterinary 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 ethnopharmacology 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 stakeholders 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 stakeholders 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

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<tr>
<th>Subject</th>
<th>Master’s programme</th>
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<td>Major</td>
<td>28</td>
<td>17</td>
</tr>
<tr>
<td>Minor + Supporting</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>(minimum 6 for minor &amp; 3 for supporting)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seminar</td>
<td>01</td>
<td>02</td>
</tr>
<tr>
<td>Research</td>
<td>20</td>
<td>45</td>
</tr>
<tr>
<td>Total Credits</td>
<td>60</td>
<td>75</td>
</tr>
<tr>
<td>Compulsory Non Credit Courses</td>
<td>See relevant section</td>
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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>
<thead>
<tr>
<th>Major Subject</th>
<th>Minor Subjects*</th>
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<tbody>
<tr>
<td>Veterinary Anatomy and Histology</td>
<td>Veterinary Pathology, Veterinary Surgery and Radiology, Veterinary Physiology, Veterinary Biochemistry</td>
</tr>
<tr>
<td>Veterinary Biochemistry</td>
<td>Veterinary Physiology, Veterinary Microbiology, Veterinary Clinical Medicine, Ethics &amp; Jurisprudence, Animal Biotechnology, Veterinary Pharmacology &amp; Toxicology, Animal Nutrition, Animal Genetics &amp; Breeding</td>
</tr>
<tr>
<td>Veterinary Physiology</td>
<td>Veterinary Anatomy and Histology, Veterinary Biochemistry, Veterinary Pharmacology &amp; Toxicology, Animal Nutrition, Animal Reproduction Gynaecology and Obstetrics, Livestock Production and Management, Animal Genetics &amp; Breeding</td>
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* 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

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

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
Detail 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

VAN 603 MYOLOGY, ANGIOLOGY, NEUROLOGY AND AESTHESIOLOGY OF OX

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


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


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

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

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

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

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

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

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

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  HISTOENZYMOLGY 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

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.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

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHE 601</td>
<td>FUNDAMENTALS OF VETERINARY AND ANIMAL HUSBANDRY EXTENSION</td>
<td>2+1</td>
</tr>
<tr>
<td>AHE 602</td>
<td>COMMUNICATION FOR LIVESTOCK DEVELOPMENT</td>
<td>1+1</td>
</tr>
<tr>
<td>AHE 603</td>
<td>DIFFUSION AND ADOPTION OF ANIMAL HUSBANDRY PRACTICES</td>
<td>2+1</td>
</tr>
<tr>
<td>AHE 604</td>
<td>EXTENSION TECHNIQUES AND AUDIO VISUAL AIDS</td>
<td>2+1</td>
</tr>
<tr>
<td>AHE 605</td>
<td>ANIMAL HUSBANDRY PROGRAMME PLANNING AND EVALUATION</td>
<td>2+1</td>
</tr>
<tr>
<td>AHE 606</td>
<td>RESEARCH METHODOLOGY IN VETERINARY AND ANIMAL HUSBANDRY EXTENSION</td>
<td>2+1</td>
</tr>
<tr>
<td>AHE 607</td>
<td>SOCIAL PSYCHOLOGY AND GROUP DYNAMICS</td>
<td>2+1</td>
</tr>
<tr>
<td>AHE 608</td>
<td>ANIMAL HUSBANDRY DEVELOPMENT PROGRAMMES</td>
<td>1+0</td>
</tr>
<tr>
<td>AHE 609</td>
<td>DEVELOPMENTS IN THE CONCEPT OF EXTENSION</td>
<td>1+0</td>
</tr>
<tr>
<td>AHE 610</td>
<td>HUMAN RESOURCE MANAGEMENT IN ANIMAL HUSBANDRY SECTOR</td>
<td>2+1</td>
</tr>
<tr>
<td>AHE 611</td>
<td>GENDER AND LIVESTOCK DEVELOPMENT</td>
<td>1+0</td>
</tr>
<tr>
<td>AHE 612</td>
<td>INFORMATION AND COMMUNICATION TECHNOLOGY IN LIVESTOCK DEVELOPMENT</td>
<td>1+1</td>
</tr>
<tr>
<td>AHE 691</td>
<td>MASTER'S SEMINAR</td>
<td>1+0</td>
</tr>
<tr>
<td>AHE 699</td>
<td>MASTER'S RESEARCH</td>
<td>20</td>
</tr>
<tr>
<td>AHE 701</td>
<td>ORGANIZATIONAL MANAGEMENT</td>
<td>3+0</td>
</tr>
<tr>
<td>AHE 702</td>
<td>FARM JOURNALISM AND PUBLIC RELATIONS</td>
<td>2+1</td>
</tr>
<tr>
<td>AHE 703</td>
<td>ADVANCED RESEARCH TECHNIQUES IN SOCIAL RESEARCH</td>
<td>3+1</td>
</tr>
<tr>
<td>AHE 704</td>
<td>TRAINING FOR HUMAN RESOURCE DEVELOPMENT</td>
<td>2+1</td>
</tr>
<tr>
<td>AHE 705</td>
<td>POLICIES AND REGULATIONS IN LIVESTOCK SECTOR</td>
<td>2+0</td>
</tr>
<tr>
<td>AHE 706</td>
<td>EDUCATIONAL TECHNOLOGY</td>
<td>2+1</td>
</tr>
<tr>
<td>AHE 707</td>
<td>DYNAMICS OF CHANGE</td>
<td>2+0</td>
</tr>
<tr>
<td>AHE 708</td>
<td>ORGANIZATIONAL COMMUNICATION</td>
<td>2+1</td>
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<tr>
<td>AHE 790</td>
<td>SPECIAL PROBLEM</td>
<td>0+2</td>
</tr>
<tr>
<td>AHE 791</td>
<td>DOCTORAL SEMINAR I</td>
<td>1+0</td>
</tr>
<tr>
<td>AHE 792</td>
<td>DOCTORAL SEMINAR II</td>
<td>1+0</td>
</tr>
<tr>
<td>AHE 799</td>
<td>DOCTORAL RESEARCH</td>
<td>45</td>
</tr>
</tbody>
</table>
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
Mosher AT. 1978. An Introduction to Agricultural Extension. ADC.
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, feedback and barriers to communication.
UNIT III
Group and mass communication. Modern communication technologies. Key communicators and their role in animal husbandry development.

Practical

Suggested Readings

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
UNIT II

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

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

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.
AHE 605  ANIMAL HUSBANDRY PROGRAMME  2+1  PLANNING AND EVALUATION

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

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


**AHE 606**  
**RESEARCH METHODOLOGY IN VETERINARY AND ANIMAL HUSBANDRY EXTENSION**

**Objective**  
To apprise the students about the selection criteria of research problem, variables, research design, sampling techniques, data collection procedure and report writing in the field of animal husbandry extension.

**Theory**

**UNIT I**  
Concept, nature and scope of research in social sciences. Types of research- fundamental, applied and action research, experimental and non-experimental research. Variables, types and their measurement. Selection and formulation of research problem. Hypothesis– importance, selection criteria (quality of workable hypothesis), formulation and testing of hypothesis.

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

**UNIT III**  

**UNIT IV**  

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

**Suggested Readings**


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

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
Brace Javanovich Inc.

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

Suggested Readings

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

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

Suggested Readings

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

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

Theory
UNIT I

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
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

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

Suggested readings

AHE 612    INFORMATION AND COMMUNICATION  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 network – 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

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

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, newspapers, 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

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

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
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

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

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.blackwellpublishing.co (International Journal of Training & Development)
* 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

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>CREDITS</th>
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<td>CHEMISTRY OF ANIMAL CELL</td>
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<tr>
<td>VBC 602</td>
<td>TECHNIQUES IN BIOCHEMISTRY</td>
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<td>VBC 603</td>
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<td>NUTRITIONAL BIOCHEMISTRY</td>
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<td>ENDOCRINE CONTROL OF FUEL METABOLISM</td>
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</table>
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

VBC 602  TECHNIQUES IN BIOCHEMISTRY   0+2

Objective
To make students well versed with methodologies used in biochemistry.

Practical
Ultracentrifugation– its principle and use, preparative analytical and density gradient ultracentrifugation. Fractionation of sub-cellular components and molecular weight determination using ultracentrifuge.

Suggested Readings
CBS.

**VBC 603**

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

**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**

**UNIT III**

**Suggested Readings**

**VBC 604**

**BIOCHEMISTRY OF BIOMOLECULES: CARBOHYDRATES LIPIDS AND MEMBRANE’S STRUCTURE**

**Objective**
Teaching of molecular basis of structure and functional aspects of carbohydrates and lipids.
Theory

UNIT I

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

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

Suggested Readings

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

UNIT III
Suggested Readings


VBC 606 METABOLISM-I: CARBOHYDRATES AND LIPIDS 2+0

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

Theory

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

UNIT II
Overview of carbohydrate and lipid cycles, control of glycolysis, glycolysis in cancer cells, control of pentose phosphate pathways, deficiency of glucose-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


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 pyrimidine metabolism.

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

Suggested Readings

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

Suggested Readings

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
UNIT III
Actin structure, microfilament dynamics, actin-myosin reacting cycle, tubulin dimer, microtubules dynamics, kinensins, dyeins.
UNIT IV
Antigen-antibody binding, cytokines, principles of immunochemical methods: agglutination, precipitation, typing of major histo-compatibility antigens. Blood group substances in farm animals.
UNIT V

Suggested Readings

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

UNIT IV

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
Jurisica I & Wigle D. 2006. Knowledge and Discovery in Proteomics. CRC.

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

UNIT III
Anemias of the newborn, cytosolic enzyme deficiencies and membrane abnormalities in erythrocytes. Porphyrisns 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
insufficiency. Metabolic diseases of Ca, P, Mg metabolism. Iron overload
and injection, inorganic polyphosphate metabolism.

Suggested Readings
David L Nelson & Cox Michael M. 2007. Lehninger’s Principles of
Biochemistry. 4th Ed. Freeman.
Animals. 5th Ed. Academic Press.
at the Molecular Level. 2nd Ed. John Wiley & Sons.

VBC 612 ENDOCRINOLOGY AND REPRODUCTIVE BIOCHEMISTRY 2+0

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

Theory
UNIT I
Mechanism of hormone action, Receptor binding, biosynthetic and
metabolic aspects in physio-pathology of hormones, factors, and minerals.
UNIT II
Metabolic functions of the hormones of the hypothalamus, pituitary,
thyroid, parathyroid, pancreas, adrenal, pineal, ovaries and testes.
Biochemistry of prostaglandins and related agents. Clinical endocrine
aspects in production and reproduction status in domestic animals and
poultry.

Suggested Readings
Nes WR & McKeen ML. 1977. Biochemistry of Steroids and other
Isoprenoids. University Park Press.
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

VBC 701 ADVANCES IN BIOCHEMISTRY OF RUMINANT DISORDERS

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

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 fingerprinting, 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 and 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.

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 ENZYMEOLOGY - 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 ENZYMEOLOGY - 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 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](http://www.niscair.res.in/ScienceCommunication) (Indian Journal of Biochemistry)
* [www.medind.nic.in/iaf/iafm.shtml](http://www.medind.nic.in/iaf/iafm.shtml) (Indian Journal of Clinical Biochemistry)
* [www.iicb.co.in](http://www.iicb.co.in) (Indian Journal of Clinical Biochemistry)
* [www.mcponline.org](http://www.mcponline.org) (Molecular & Cellular Proteomics)
* [www.elsevier.com/vj/proteomics](http://www.elsevier.com/vj/proteomics) (Proteomics Virtual Journal)
* [www.elsevier.com](http://www.elsevier.com) (Journal of Proteomics)
* [www.elsevier.com](http://www.elsevier.com) (Clinical Biochemistry)
* [www.sciencedirect.com/science/journal](http://www.sciencedirect.com/science/journal) (Science Direct –Clinical Biochemistry)
* [www.jbc.org](http://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

<table>
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<tr>
<td>VPY 606</td>
<td>PHYSIOLOGY OF ANIMAL REPRODUCTION</td>
<td>2+1</td>
</tr>
<tr>
<td>VPY 607</td>
<td>CLINICAL PHYSIOLOGY</td>
<td>2+1</td>
</tr>
<tr>
<td>VPY 608</td>
<td>NEUROMUSCULAR PHYSIOLOGY</td>
<td>2+1</td>
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<tr>
<td>VPY 609</td>
<td>CHEMICAL BIOREGULATION IN PHYSIOLOGICAL FUNCTIONS</td>
<td>3+0</td>
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<tr>
<td>VPY 610</td>
<td>RESEARCH TECHNIQUES IN VETERINARY PHYSIOLOGY</td>
<td>0+2</td>
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<tr>
<td>VPY 691</td>
<td>MASTER’S SEMINAR</td>
<td>1+0</td>
</tr>
<tr>
<td>VPY 699</td>
<td>MASTER’S RESEARCH</td>
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</tr>
<tr>
<td>VPY 701</td>
<td>APPLIED PHYSIOLOGY OF BODY FLUIDS AND ELECTROLYTES</td>
<td>2+1</td>
</tr>
<tr>
<td>VPY 702</td>
<td>PHYSIOLOGY OF ANIMAL BEHAVIOUR</td>
<td>2+0</td>
</tr>
<tr>
<td>VPY 703</td>
<td>COMPARATIVE PHYSIOLOGY OF RUMINANT DIGESTION</td>
<td>2+1</td>
</tr>
<tr>
<td>VPY 704</td>
<td>ADVANCES IN NEURO-ENDOCRINOLOGY</td>
<td>2+1</td>
</tr>
<tr>
<td>VPY 705</td>
<td>MYOPHYSIOLOGY AND KINESIOLOGY</td>
<td>2+1</td>
</tr>
<tr>
<td>VPY 706</td>
<td>AVIAN PHYSIOLOGY</td>
<td>2+1</td>
</tr>
<tr>
<td>VPY 707</td>
<td>PHYSIOLOGY OF LACTATION</td>
<td>2+1</td>
</tr>
<tr>
<td>VPY 708</td>
<td>ADVANCES IN ENVIRONMENTAL PHYSIOLOGY AND GROWTH</td>
<td>2+1</td>
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<tr>
<td>VPY 709</td>
<td>ADVANCES IN RUMEN MICROBIOLOGY AND METABOLISM</td>
<td>2+1</td>
</tr>
<tr>
<td>VPY 710</td>
<td>ADVANCES IN IMMUNOPHYSIOLOGY</td>
<td>2+1</td>
</tr>
<tr>
<td>VPY 711</td>
<td>PHYSIOLOGY OF STRESS</td>
<td>2+1</td>
</tr>
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<td>VPY 790</td>
<td>SPECIAL PROBLEM</td>
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<td>VPY 799</td>
<td>DOCTORAL RESEARCH</td>
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</tr>
</tbody>
</table>
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

Suggested Readings

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

Suggested Readings

VPY 603 RENAL PHYSIOLOGY AND BODY FLUID DYNAMICS 2+1
Objective
To impart knowledge regarding excretory system of mammals and birds, maintenance of body fluid homeostasis.

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

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

UNIT III

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**


**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**

**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**


**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

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

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

Suggested Readings

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
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

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

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

UNIT V

Suggested Readings
VPY 610
RESEARCH TECHNIQUES IN VETERINARY PHYSIOLOGY

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

Practical

Suggested Readings

VPY 701
APPLIED PHYSIOLOGY OF BODY FLUIDS AND ELECTROLYTES

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
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

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
UNIT III
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

Practical

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

Practical

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
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

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

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](http://intl-joe.endocrinology-journals.org) (Journal of Endocrinology)
* [http://arjournals.annualreviews.org](http://arjournals.annualreviews.org) (Annual Review of Physiology)
* [www.jneurosci.org](http://www.jneurosci.org) (Journal of Neuroscience)
* [http://jp.physioc.org](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)

<table>
<thead>
<tr>
<th>CODE</th>
<th>COURSE TITLE</th>
<th>CREDITS</th>
</tr>
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<tbody>
<tr>
<td>PGS 501</td>
<td>LIBRARY AND INFORMATION SERVICES</td>
<td>0+1</td>
</tr>
<tr>
<td>PGS 502</td>
<td>TECHNICAL WRITING AND COMMUNICATIONS SKILLS</td>
<td>0+1</td>
</tr>
<tr>
<td>PGS 503 (e-Course)</td>
<td>INTELLECTUAL PROPERTY AND ITS MANAGEMENT</td>
<td>1+0</td>
</tr>
<tr>
<td>PGS 506 (e-Course)</td>
<td>DISASTER MANAGEMENT</td>
<td>1+0</td>
</tr>
</tbody>
</table>

### 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


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

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 biodiversity 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

Disaster Management

PGS 506 (e-Course) 1+0

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

