NEW AND RESTRUCTURED
POST-GRADUATE CURRICULA & SYLLABI

Veterinary Para-clinical Subjects

Veterinary Microbiology
Veterinary Parasitology
Veterinary Pathology
Veterinary Pharmacology and Toxicology
Veterinary Public Health

Education Division
Indian Council of Agricultural Research
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Contents

EXECUTIVE SUMMARY

I. The New Approach

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

II. Credit Requirements

- Common academic regulations for post graduate education in SAUs, DUs and CAU as proposed in table 2 will be followed with slight adjustments to accommodate specific and special needs to build up and enhance the knowledge based competence of the veterinary students as given below.
- The total course work of 40 credit hours has been proposed at M.V.Sc. level instead of minimum requirement 35 credit hours (Table 2), 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 subjects (specified in table-1) and supporting subjects together -11 credits.
- Out of 11 credit hours for minor and supporting subjects, courses with a minimum of 6 credits should be taken from minor subject and courses with 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 Microbiology

- Specialization at Masters level in Veterinary Microbiology and Veterinary Immunology has been abolished and there will be one unified masters programme i.e. M.V.Sc (Veterinary Microbiology)
- Contents of existing 31 courses (17 of Microbiology and 14 of Immunology) have been encapsulated in to 9 courses which are all mandatory.
- To keep upfront with the latest developments at doctoral level, 16 out of 18 proposed courses have been framed afresh.

Veterinary Parasitology

- VPA 605 [Parasitological techniques] course contents upgraded to include the latest techniques e.g. Application of remote sensing and geographical information system in Parasitology.
- VPA 611 [Malacology] designed to emphasize the study of intermediate hosts.
- Courses namely VPA 701 [Applications of remote sensing and geographic information system in Parasitology]; VPA 702 [Molecular diagnostics and vaccine development in Parasitology]; VPA 703 [Host parasite interactions]; VPA 708 [*In vitro* cultivation of parasites]; VPA 709 [Emerging and re-emerging parasitic diseases]; VPA 710 [Bionomics of parasites] and VPA 711 [Environmental Parasitology] added to cope up with the unprecedented growth of information in the field

Veterinary Pathology

- VPP 605 and VPP 606 [Necropsy procedures and interpretations –I & II] are new practical oriented courses designed to enhance the interpretation skills.
- VPP 609 [Toxicopathology] previously a doctorate level course has been tailored for Masters.
- VPP 610 [Avian pathology] and VPP 707 [Advances in avian pathology] redesigned to include other avian species besides poultry.
- VPP 612 [Veterolegal pathology] designed in view of increasing veterolegal cases requiring specialized knowledge.
- VPP 704 [Ultrastructural pathology] designed to expose students to ultrastructural pathology.
- VPP 706 [Pathology of important and emerging diseases of pets and livestock] designed to teach emerging diseases of pets and livestock.
- VPP 709 [Molecular pathology of cell injury] and VPP 710 [Experimental pathology] designed in view of latest developments.

Veterinary Pharmacology and Toxicology

- VPT 610 [Pharmacological techniques] redesigned course to include latest techniques.
- VPT 612 [Ethnopharmacology] redesigned to include alternative system of medicine for animals.

Veterinary Public Health

- VPH 608 [Environmental pollution and safety] introduced at Masters level, earlier it was scheduled for doctoral students.
- VPH 609 (Fish, fish products and seafood hygiene) and VPH 610 (Disaster management and bioterrorism)- New course added to meet the present day requirements
- Doctorate level new courses designed to bring in novelty and advances in the field e.g. VPH 702 [Emerging and reemerging zoonoses]; VPH 703 [Quality control of animal food products]; VPH 704 [Occupational health hazards]; VPH 705 [Disposal and recycling of waste]; VPH 706 [Biohazards, bio-security and disaster management] and VPH 707 [Food plant sanitation].

BSMA Committee on Veterinary Paraclinical Sciences

(Vety. Micro, Pathology, Pharma. & Toxicology, Parasitology, Immunology, Virology)

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

Name	Address	Specialization
Dr. S. K. Jand Dean, PGS ***Convener***	GADVASU, Ludhiana	Microbiology
Dr. G. Krishnan Nair Prof. & Head	Dept. of Vety. Microbiology, College of Vety. & Animal Sciences, Mannuthy, Trichur	Microbiology
Dr. D. Kumar Prof. & Head	Dept. of Vety. Parasitology, RGCOVAS, Pondicherry	Parasitology
Dr. R. Somvanshi Principal Sci. & Head	Division of Pathology, IVRI, Izatnagar	Pathology
Dr. M. L. Satyanarayana Prof. & Head	Dept. of Vety. Pathology, Vety. College, Hebbal, Bangalore	Pathology
Dr. A. K. Srivastava Dean	SKUAST, Jammu	Pharmacology
Dr. Satish Garg Prof. & Head	Dept. of Pharmacology, Mathura Vety. College, Mathura	Pharmacology
Dr. P. K. Kapur Professor	I/C, DFSAH, CCS HAU, Hisar	Public Health
Dr. S.K. Gupta Prof. & Head ***Member Secretary***	Dept. of Parasitology, COVS, CCS HAU Hisar	Parasitology

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

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

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

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

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

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

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

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

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

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

ORGANIZATION OF COURSE CONTENTS
&
CREDIT REQUIREMENTS

Code Numbers

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

Course Contents

The contents of each course have been organized into:

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

Minimum Credit Requirements

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

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

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

Major Subject	Minor Subjects
Veterinary Microbiology	Animal Biotechnology, Veterinary Epidemiology & Preventive Medicine, Veterinary Pathology, Veterinary Public Health, Veterinary Biochemistry
Veterinary Parasitology	Veterinary Epidemiology & Preventive Medicine, Veterinary Microbiology, Veterinary Pharmacology & Toxicology, Animal Biotechnology, Veterinary Pathology, Veterinary Biochemistry
Veterinary Pathology	Veterinary Microbiology, Veterinary Anatomy and Histology, Veterinary Clinical Medicine, Ethics & Jurisprudence, Veterinary Parasitology, Veterinary Pharmacology & Toxicology, Animal Nutrition
Veterinary Pharmacology and Toxicology	Veterinary Physiology, Veterinary Biochemistry, Veterinary Clinical Medicine, Ethics & Jurisprudence, Veterinary Pathology, Animal Biotechnology
Veterinary Public Health	Veterinary Epidemiology and Preventive Medicine, Veterinary Microbiology, Veterinary Pathology, Animal Biotechnology, Veterinary Pharmacology & Toxicology, Veterinary Parasitology, Livestock Product Technology

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

VETERINARY MICROBIOLOGY

Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
VMC 601	BACTERIOLOGY – I	3+1
VMC 602	BACTERIOLOGY – II	3+1
VMC 603	VETERINARY MYCOLOGY	1+1
VMC 604	GENERAL VIROLOGY	2+1
VMC 605	SYSTEMATIC ANIMAL VIROLOGY	3+1
VMC 606	PRINCIPLES OF IMMUNOLOGY	2+1
VMC 607	VACCINOLOGY	2+0
VMC 608	DIAGNOSTICS OF INFECTIOUS DISEASES	1+2
VMC 609	TECHNIQUES IN MICROBIOLOGY AND IMMUNOLOGY	0+3
VMC 691	MASTER'S SEMINAR	1+0
VMC 699	MASTER'S RESEARCH	20
VMC 701	ADVANCES IN BACTERIOLOGY	2+1
VMC 702	ADVANCES IN MYCOLOGY	2+1
VMC 703	BACTERIAL GENETICS	2+1
VMC 704	MICROBIAL TOXINS	2+1
VMC 705	MOLECULAR DETERMINANTS OF BACTERIAL PATHOGENESIS	2+1
VMC 706	ADVANCES IN VIROLOGY	2+1
VMC 707	MOLECULAR AND GENETIC ASPECTS OF VIRAL PATHOGENESIS	2+1
VMC 708	STRUCTURE FUNCTION RELATIONSHIP OF DNA AND RNA VIRUSES	3+0
VMC 709	ONCOGENIC VIRUSES	2+0
VMC 710	SLOW VIRAL INFECTIONS AND PRIONS	2+0
VMC 711	MOLECULAR IMMUNOLOGY	2+1
VMC 712	ADVANCES IN CELLULAR IMMUNOLOGY	2+1
VMC 713	CYTOKINES AND IMMUNOMODULATORS	2+0
VMC 714	ADVANCES IN VACCINOLOGY	2+0
VMC 715	ADVANCES IN IMMUNODIAGNOSTICS	1+1
VMC 716	MODERN IMMUNOTECHNOLOGY	1+2
VMC 717	CURRENT TOPICS IN INFECTION AND IMMUNITY	3+0
VMC 718	VETERINARY MICROBIAL BIOTECHNOLOGY	2+1
VMC 790	SPECIAL PROBLEM	0+2
VMC 791	DOCTORAL SEMINAR I	1+0
VMC 792	DOCTORAL SEMINAR II	1+0
VMC 799	DOCTORAL RESEARCH	45

VETERINARY MICROBIOLOGY

Course Contents

VMC 601 BACTERIOLOGY - I 3+1

Objective

To impart knowledge on general microbiology and important aerobic bacteria.

Theory

UNIT I

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

UNIT II

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

UNIT III

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

Practical

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

Suggested Readings

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

Prescot LM, Harley JP & Klen DA. 2005. *Microbiology*. Wm. C. Brown Publ.

Tortora GJ, Funke BR & Case CL. 2004. *Microbiology: An Introduction*. Benjamin/Cummins Publ.

VMC 602 BACTERIOLOGY - II 3+1

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

Practical

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

Suggested Readings

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

Prescot LM, Harley JP & Klen DA. 2005. *Microbiology*. Wm. C. Brown Publ.

Tortora GJ, Funke BR & Case CL. 2004. *Microbiology: An Introduction*. Benjamin/Cummins Publ.

VMC 603 VETERINARY MYCOLOGY 1+1

Objective

To learn general and pathogenic mycology.

Theory

UNIT I

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

UNIT II

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

Practical

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

Suggested Readings

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

VMC 604 GENERAL VIROLOGY 2+1

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

Immune response to viruses, viral vaccines, viral chemotherapy.

Practical

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

Suggested Readings

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

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

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

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

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

VMC 605 SYSTEMATIC ANIMAL VIROLOGY 3+1

Objectives

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

Theory

UNIT I

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

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

UNIT II

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

UNIT III

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

Practical

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

Suggested Readings

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

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

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

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

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

VMC 606 PRINCIPLES OF IMMUNOLOGY 2+1

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

Practical

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

Suggested Readings

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

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

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

VMC 607 VACCINOLOGY 2+0

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

Suggested Readings

Dodds WJ & Schulz R. (Eds). 1999. *Veterinary Vaccines and Diagnostics*. Vol. 41 (*Advances in Veterinary Medicine*) 1st Ed. Academic Press.

Levine MM, Kaper JB, Rappuoli R, Liu MA & Good MF. 2004. *New Generation Vaccines*. 3rd Ed. Marcel-Dekker.

Pastoret PP, Blancou J, Vannier C & Verschueren C. 1997. *Veterinary Vaccinology*. Elsevier.

VMC 608 DIAGNOSTICS OF INFECTIOUS DISEASES 1+2

Objective

To provide training in essential immunological and molecular diagnostic techniques.

Theory

UNIT I

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

UNIT II

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

Practical

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

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

Suggested Readings

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

Rose NR, Friedman H & Fahey JL. (Eds). 1986. *Manual of Clinical Laboratory Immunology*. American Society for Microbiology.

Weir DM. 1986. *Handbook of Experimental Immunology*. Vol. IV. Blackwell.

VMC 609 TECHNIQUES IN MICROBIOLOGY AND IMMUNOLOGY 0+3

Objective

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

Practical

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

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

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

Suggested Readings

Coligan JE, Kruisbeek AM, Margulies DH, Shevach EM & Strober W. 2003. *Current Protocols in Immunology*. 3rd Ed. John Wiley & Sons.

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

Hay FC & Westwood OMR. 2002. *Practical Immunology*. 4th Ed. Blackwell.

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

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

VMC 701 ADVANCES IN BACTERIOLOGY 2+1

Objective

To learn about the latest development in the field of bacteriology

Theory

UNIT I

Advanced studies on cytology, biochemical activities, antigenic structure and molecular biology of bacteria

UNIT II

Advanced studies on pathogenicity, immunology and serology of bacteria.

Practical

Biochemical, physiological and pathogenesis studies of various bacterial diseases**.**

Suggested Readings

Selected articles from journals

VMC 702 ADVANCES IN MYCOLOGY 2+1

Objective

To learn about the latest development in the field of mycology.

Theory

UNIT I

Advanced studies on taxonomic genetics, physiology and antigenic characterization of pathogenic fungi.

UNIT II

Advanced studies on molecular approaches for identification of fungi and immunology and serology of mycoses.

Practical

Biochemical, physiological and pathogenesis studies of various fungal diseases**.**

Suggested Readings

Selected articles from journals

VMC 703 BACTERIAL GENETICS 2+1

Objective

To learn the basic aspects of bacterial genetics.

Theory

UNIT I

Procaryotic and Eucaryotic genome. Replication of eucaryotic and procaryotic DNA. Structure, classification and replication of plasmids. Molecular basis of mutations.

UNIT II

Biochemical genetic and gene mapping by recombination, fine gene structure analysis. Gene transfer in bacteria through transduction, transformation and conjugation and gene mapping by these processes.

UNIT III

Transposable elements. Gene cloning and gene sequencing. Regulation of gene expression.

Practical

Mutagenesis of microorganisms by different methods. Production, isolation and characterization of mutants. Determination of mutation rate. Isolation, characterization and curing of plasmids. Transfer of plasmid by conjugation, electroporation. Tetrad and random spore analysis.

Suggested Readings

Selected articles from journals.

VMC 704 MICROBIAL TOXINS 2+1

Objective

To learn about the bacterial and fungal toxins.

Theory

UNIT I

The role of microbial toxins in the pathogenesis of diseases; biochemical and biological characteristics of toxins produced by various bacteria. Toxin

producing Gram positive and negative bacteria. Properties and clinical conditions produced by different bacterial toxins.

UNIT II

Production, characterization, and study of pathogenicity of various fungal toxins.

Practical

Isolation of toxigenic strains of bacteria from suspected material, production of toxins in suitable media, purification and characterization of toxins; biological characterization in animal and in tissue culture; immunobiological studies of toxins.

Suggested Readings

Selected articles from journals.

VMC 705 MOLECULAR DETERMINANTS OF BACTERIAL PATHOGENESIS 2+1

Objective

To learn the molecular mechanisms of bacterial pathogenesis.

Theory

UNIT I

Molecular structure, production and mode of action of bacterial adhesins, invasions, impedins, agressins, modulins, capsule, flagella, enzymes, components of cell wall and siderophores.

UNIT II

The production, structure and molecular mechanism of actions of various exotoxins and endotoxins, siderophores and cytotoxins, and plasmids in causation of disease.

Practical

To study the production and effects of exotoxins and endotoxins, LPS and various enzymes produced by the bacteria on various cell culture and live animals.

Suggested Readings

Selected articles from journals.

VMC 706 ADVANCES IN VIROLOGY 2+1

Objective

Advanced study of virus structure, their nucleic acids and proteins; latest trends in animal virus research.

Theory

UNIT I

Biology of RNA and DNA virus replication.

UNIT II

Current concepts in animal virus research with respect to viral structure and architecture, viral virulence, viral pathogenesis, persistence and oncogenesis.

UNIT III

Latest trends in the development of antivirals.

UNIT IV

Cloning and expression in viral vectors.

Practical

Separation and characterization of viral proteins, and nucleic acid by polyacrylamide gel electrophoresis, column chromatography, blotting

techniques. Problem oriented practical assignments aimed at development of bioreagents and relevant diagnostic tests. Screening and evaluation of antiviral agents for efficacy and toxicity.

Suggested Readings

Selected articles from journals.

VMC 707 MOLECULAR AND GENETIC ASPECTS OF VIRAL PATHOGENESIS 2+1

Objective

To study molecular and genetic determinants of viral virulence and pathogenesis; animal models for studying viral pathogenesis.

Theory

UNIT I

Mechanisms of viral infection and spread through the body; detailed study of virus host interactions.

UNIT II

Host immune responses to viral infections; viral strategies to evade host immune responses.

UNIT III

Pathogenesis of viral diseases of various systems; animal models for studying viral pathogenesis; molecular and genetic determinants of viral virulence; mechanisms of viral virulence.

UNIT IV

Molecular and genetic determinants of viral persistence, viral oncogenesis, viral immunosuppression, and immunopathology. Animal models for studying viral pathogenesis.

Practical

Pathotyping of animal viruses using Newcastle disease virus as model; Determination of immunosuppressive potential of animal viruses using infectious bursal disease virus/ Marek's disease virus/ chicken anemia virus; characterization of molecular determinants of viral virulence using variants, recombinants and reassortants; isolation and molecular characterization of viruses with varying virulence.

Suggested Readings

Selected articles from journals.

VMC 708 STRUCTURE FUNCTION RELATIONSHIP OF DNA AND RNA VIRUSES 3+0

Objective

To understand the relationship between structure and function of DNA and RNA viruses of animals for the development of next generation viral vaccine and antivirals.

Theory

UNIT I

Methods of studying virus structure and architecture; methods of amplification of viral nucleic acids; molecular characterization of viral protein and nucleic acid, nucleotide sequencing, and its analysis by software programmes.

UNIT II

Detailed study of virus replication in various groups of animal viruses.

UNIT III

Understanding the relationship between structure and function of animal DNA and RNA viruses, development of modern vaccines and antivirals using the relationship between structure and function of animal DNA and RNA viruses.

Suggested Readings

Selected articles from journals.

VMC 709 ONCOGENIC VIRUSES 2+0

Objective

To study mechanisms of viral oncogenesis.

Theory

UNIT I

General features of cell transformation and characterization of transformed cells; Oncogenic RNA and DNA viruses; expression of viral and cellular oncogenes.

UNIT II

Mechanisms of viral oncogenesis; Diagnosis of viral oncogenesis.

Suggested Readings

Selected articles from journals.

VMC 710 SLOW VIRAL INFECTIONS AND PRIONS 2+0

Objective

To study slow viral infections; properties and replication of prions, and diseases caused by them.

Theory

UNIT I

Epidemiology, pathogenesis, diagnosis and control of slow viral infections.

UNIT II

Properties, replication and epidemiology of prions. Pathogenesis, immunity, diagnosis and control of various diseases caused by prions; recent trends in prion research.

Suggested Readings

Selected articles from journals.

VMC 711 MOLECULAR IMMUNOLOGY 2+1

Objective

To familiarize with advances in research on immune system molecules such as antigens, antibodies, complement, cytokines, surface molecules, etc.

Theory

UNIT I

Pathogen associated molecular patterns and pattern recognition receptors in immunity. Advances in characterization of antigens and superantigens, epitope mapping. Novel functions of immunoglobulins and their fragments produced by rDNA technology.

UNIT II

Cytokines and cytokine receptors: structure and function. Complement components genes and polymorphism. MHC genes. Evolutionary aspects of recombination activating genes-mediated immunity in vertebrates.

UNIT III

Immunoinformatics as applied to MHC molecules-peptide complexes and other molecules. Immunomics.

Practical

Purification of immunoglobulin classes and IgG subclasses, IgG fragments production by pepsin and papain digestion, cytokine quantitation and detection by ELISPOT assay, IgV gene amplification and sequencing, use of immunoinformatic tools to Ig genes.

Suggested Readings

Selected articles from journals.

VMC 712 ADVANCES IN CELLULAR IMMUNOLOGY 2+1

Objective

To learn advances in research on immune cell biology and cellular interactions in immune responses.

Theory

UNIT I

Hematopioetic stem cells and differentiation pathways of various leukocytes. B and T lymphocyte repertoires. Lymphocyte- endothelial cell interactions during lymphocyte emigration and recirculation. Antigen presenting cells, T cell subsets, regulatory T cells, memory B and T cells. NK cell biology.

UNIT II

Cellular interactions during immune response development: microenvironments, antigen processing and presentation, activation of B and T cells, co-stimulatory molecules, cytokines in intercellular communication. Signal transduction pathways in B and T cell activation.

UNIT III

Immunoregulation of B and T cell response. Mucosal immune system. Oral tolerance and its breakdown. Advances in transplantation immunology. SCID, gene-knockout and transgenic animals in immunobiology research.

Practical

Fluorescence activated and magnetic cell sorting of lymphocyte subsets, Lymphocyte proliferation assays using non-radioisotope methods, adoptive transfer of lymphocyte subsets, cytotoxic T cell assays, ELISPOT assays for enumeration of lymphocyte subsets secreting cytokines.

Suggested Readings

Selected articles from journals.

VMC 713 CYTOKINES AND IMMUNOMODULATORS 2+0

Objective

To learn about structure and function of various cytokines and other immunomodulators.

Theory

UNIT I

Cytokines and immunomodulators: definitions and classification. Cytokines structure and functions. Cytokine receptors: structural types and presence on different cells. Roles in activation, division and differentiation of immune cells, and immunoregulation.

UNIT II

Cytokine networks. cytokines in reproductive processes and neuro-endocrino- immunological interactions. Immunomodulators in control of diseases. Cytokines as adjuvants and imunomodulators. Colony stimulating factors and other cytokines in stem cell research.

Suggested Readings

Selected articles from journals.

VMC 714 ADVANCES IN VACCINOLOGY 2+0

Objective

To learn about advances in vaccine research and modern approaches to vaccine development.

Theory

UNIT I

Advances in vaccine development research. Antigen identification and characterization employing newer molecular technologies such as microarrays, *in vivo* expression technology, signature-tagged mutagenesis and phage display technology, etc.

UNIT II

Immunoinformatics as applied to epitope mapping, T cell epitopes, identification of pathogenic epitopes, etc. Novel vaccines: nucleic acids, marker vaccines, mucosal vaccines, bacterial ghosts as vaccines, virus-like particles. Futuristic vaccines: anti-allergic, anti-autoimmune diseases, de-addiction vaccines, transplant survival/ prolonging vaccines etc.

Suggested Readings

Selected articles from journals.

VMC 715 ADVANCES IN IMMUNODIAGNOSTICS 1+1

Objective

To learn and employ modern approaches to immunodiagnosis.

Theory

Newer methods of immunodiagnosis: simple, rapid, penside immunodiagnostic tests such as immunochromatofocussing, immunofiltration tests, etc. Development of highly sensitive enzyme immunoassays such as immuno-PCR, use of luminescent substrates, etc. Disciminant immunoassays for differentiating cross-reactive antigens. Antibodies in biosensors.

Practical

Development of immunofiltration test using monoclonal antibody for diagnosis of any veterinary infectious disease. Blocking ELISA to differentiate cross-reactive antigens.

Suggested Readings

Selected articles from journals.

VMC 716 MODERN IMMUNOTECHNOLOGY 1+2

Objective

To provide training on production of monoclonal antibody and other immunobiologicals by various modern methods.

Theory

UNIT I

Historical developments in modern immunotechnology. Hybridoma technology: advances in monoclonal antibody production. Chimeric and humanized monoclonal antibodies.

UNIT II

Recombinant DNA technology for expression of antibody fragments: Fab, scFv, bispecific antibody, nanobody and various other antibody formats**.** Modern uses of antibody fragments: biosensors, catalysis, therapeutics, *in vivo* imaging, microarrays, proteomics, etc.

Practical

Production of murine monoclonal antibody against antigens of infectious agents by hydridoma technique. Production of phage display library of scFv or camel nanobody. Selection of antigen-specific phage displayed antibody fragment by panning or other techniques.

Suggested Readings

Selected articles from journals.

VMC 717 CURRENT TOPICS IN INFECTION AND IMMUNITY 3+0

Objective

Discussions on recent developments in the immunobiology of major viral, bacterial and fungal diseases of animals.

Theory

UNIT I

Introduction and historical developments. Host-pathogen relationship.

UNIT II

Effector mechanisms of specific and non specific immunity to different groups of microbes.

UNIT III

Immunobiology of major viral, bacterial and fungal diseases of animals. Types of vaccines in infectious diseases and current trends in vaccine development.

Suggested Readings

Selected articles from journals.

VMC 718 VETERINARY MICROBIAL BIOTECHNOLOGY 2+1

Objective

To understand as to how microbial processes and activities can be used for development of medically and industrially important products and processes.

Theory

UNIT I

History of microbial biotechnology. Microbes in nature. Microbes as infectious agents of human and animals. Host-microbe relationships. Microbial metabolism and growth characteristics. Microbial genetics.

UNIT II

Introduction to molecular biology of microorganisms: DNA, RNA and proteins structure and functions. DNA replication, RNA transcription,

reverse transcription, protein translation, regulatory mechanisms. Bacterial extrachromosomal DNA elements**.**

UNIT III

Genetic engineering: restriction enzymes, DNA ligases, DNA polymerases, RNases and DNases, other enzymes. DNA sequencing. Plasmids and phage-derived vectors, bacterial hosts for cloning and expression of transgenes. Genomic libraries and sequencing. Blotting of DNA, RNA and proteins. Polymerase chain reaction. Microarrays. Metagenomics.

UNIT IV

Expression of antigens and antibody fragments useful as diagnostic reagents and vaccines. PCR and blotting techniques in infectious disease diagnosis. Nucleic acid vaccines. Vectored viral and bacterial vaccines. Construction of defined mutants and marker vaccines using genetic manipulation techniques. Display technologies for production of immunobiologicals. Manipulation of microbial processes for production of industrially useful substances.

Practical

Extraction of nucleic acids from viruses and bacteria. Restriction endonuclease digestion of DNA and resolution in agarose gel electrophoresis. PCR amplification of DNA. RT-PCR of RNA. Insertion of DNA fragments into plasmid/phagemid/phage vectors. Construction of competent *E. coli* host cells. Transformation and transfection of competent *E. coli* cells. Screening of transformants and isolation of clones. DNA sequencing of clones/PCR amplicons. Expression of genes of bacterial/viral antigens. Use of PCR for infectious disease diagnosis.

Suggested Readings

Selected articles from journals.

VMC 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 MICROBIOLOGY

List of Journals

* Advances in Immunology
* Advances in Virus Research
* Annual Review of Immunology
* Current Topics in Microbiology and Immunology
* Immunology
* Indian Journal of Virology
* Infection and Immunity
* Journal of Bacteriology
* Journal of General Virology
* Journal of Immunology
* Journal of Virology
* Nature
* Nature Immunology
* Nature Reviews Immunology
* Science
* Trends in Biotechnology
* Trends in Immunology
* Vaccine
* Veterinary Immunology and Immunopathology
* Veterinary Microbiology
* Virology

e-Resources

* www.virology.com (Virology Journal)
* www.elsevier.com/locate/vetmic (Veterinary Microbiology)
* www.jb.asm.org (Journal of Bacteriology)
* www.jac.oxford.journals.org (Clinical Bacteriology)
* www.benthem.org/open/tomycj (The Open Mycology Journal)
* www.nature.com/nrmicro (Nature Review of Microbiology)
* www.trends.com/tim (Trends in Microbiology)
* www.arjournals.annualreviews.org/loi/micro (Annual Reviews of Microbiology)
* www.jcm.asm.org (Journal of Clinical Microbiology)
* www.trends.com/it (Trends in Immunology)
* www.arjournals.annualreviews.org/loi/immunol (Annual Reviews of Immunology)
* www.elsevier.com/locate/vaccine (Vaccine)
* www.nature.com/immunol (Nature Review of Immunology)
* www.iac.asm.org (Infection and Immunity)
* www.jaconline.com (Journal of Allergy and Clinical Immunology)
* www.elsevier.com/locate/molimm (Molecular Immunology)
* www.blackwellpublishing.com/journals/pim (Parasite Immunology)
* www.jleukbio.org (Journal of Leucocyte Biology)
* www.ocw.mit.edu (MIT Open Course Ware/Health Sciences and Technology)

Professional Course Ware Web Sites:

* www.jbpub.com
* www.bact.wisc.edu
* www.textbookbacteriology.net
* www.mhhe.com/Prescott5
* www.Highwirepress.stanford.edu
* www.vibno/Epid/supercurseforvirology

Suggested Broad Topics for Master's and Doctoral Research

* Isolation, identification and characterization of pathogenic bacteria for developing diagnostics and vaccines
* Development of genetically modified bacteria for improved vaccine and genetically modified signatured bacteria for developing vaccine candidate that can differentiate vaccinated from infected animals
* Development of molecular tools for studying evolution, quick diagnosis and molecular epidemiology of microbes
* Molecular characterization and antigenic relationship of field isolates of important viruses of animals and poultry.
* Isolation and characterization of field isolates of important viruses of livestock and poultry with the aim of development of diagnostics and candidate vaccines
* Studies on immune responses and immunity to animal and poultry viruses
* Investigation of the roles of proinflammatory cytokines in ovarian activity of buffaloes
* Production of phage display libraries of bovine scFv for diagnostic and therapeutic uses
* Development of novel delivery systems for developing mucosal veterinary vaccines

VETERINARY PARASITOLOGY

Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
VPA 601	VETERINARY HELMINTHOLOGY-I	2+1
VPA 602	VETERINARY HELMINTHOLOGY-II	2+1
VPA 603	VETERINARY ENTOMOLOGY AND ACAROLOGY	2+1
VPA 604	VETERINARY PROTOZOOLOGY	2+1
VPA 605	PARASITOLOGICAL TECHNIQUES	0+2
VPA 606	CLINICAL PARASITOLOGY	1+1
VPA 607	TRENDS IN CONTROL OF LIVESTOCK AND POULTRY PARASITES	1+1
VPA 608	IMMUNOPARASITOLOGY	2+1
VPA 609	PARASITIC ZOONOSES	2+0
VPA 610	PARASITES OF ZOO AND WILD ANIMALS	2+1
VPA 611	MALACOLOGY	1+1
VPA 691	MASTER'S SEMINAR	1+0
VPA 699	MASTER'S RESEARCH	20
VPA 701	APPLICATIONS OF REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM IN PARASITOLOGY	1+2
VPA 702	MOLECULAR DIAGNOSTICS AND VACCINE DEVELOPMENT IN PARASITOLOGY	2+1
VPA 703	HOST PARASITE INTERACTIONS	2+0
VPA 704	ADVANCES IN PROTOZOOLOGY	2+1
VPA 705	ADVANCES IN HELMINTHOLOGY-I	2+1
VPA 706	ADVANCES IN HELMINTHOLOGY-II	2+1
VPA 707	ADVANCES IN ENTOMOLOGY AND ACAROLOGY	2+1
VPA 708	*IN VITRO* CULTIVATION OF PARASITES	1+2
VPA 709	EMERGING AND RE-EMERGING PARASITIC DISEASES	2+0
VPA 710	BIONOMICS OF PARASITES	3+0
VPA 711	ENVIRONMENTAL PARASITOLOGY	1+1
VPA 790	SPECIAL PROBLEM	0+2
VPA 791	DOCTORAL SEMINAR I	1+0
VPA 792	DOCTORAL SEMINAR II	1+0
VPA 799	DOCTORAL RESEARCH	45

VETERINARY PARASITOLOGY
Course Contents

VPA 601 VETERINARY HELMINTHOLOGY - I 2+1

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

UNIT VI

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

Practical

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

Suggested Readings

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

Dalton JP. 1999. *Fasciolosis*. CABI.

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

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

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

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

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

VPA 602 VETERINARY HELMINTHOLOGY - II 2+1

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

UNIT VI

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

UNIT VII

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

Practical

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

Suggested Readings

Andersen RC. 2000. *Nematode Parasites of Vertebrates, their Development and Transmission*. CABI.

Kennedy MW & Harnett W. 2001. *Parasitic Nematodes: Molecular Biology, Biochemistry and Immunology*. CABI.

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

Lee DL. 2002. *The Biology of Nematodes*. Taylor and Francis.

Soulsby EJL. 1982. *Helminths, Arthropods and Protozoa of Domesticated Animals*. Bailliere Tindal.

VPA 603 VETERINARY ENTOMOLOGY AND ACAROLOGY 2+1

Objective

To learn various aspects of arthropods of veterinary importance.

Theory

UNIT I

Introduction, history, classification and economic importance.

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

UNIT VI

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

UNIT VII

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

UNIT VIII

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

UNIT IX

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

Practical

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

Suggested Readings

Gupta SK & Kumar R. 2003. *Manual of Veterinary Entomology and Acarology*. International Book Distr. Co.

Harwood RF & James MT. 1979. *Entomology in Human and Animal Health*. MacMillan.

Kettle DS. 1995. *Medical and Veterinary Entomology*. CABI.

Lehane M. 2005. *The Biology of Blood Sucking Insects*. 2nd Ed. Cambridge University Press.

Marquardt WC. 2000. *Parasitology and Vector Biology*. Academic Press

Mullen G & Durben L. 2002 *Medical and Veterinary Entomology*. Academic Press

Wall R & Shearer D. 1997. *Veterinary Entomology*. Chapman & Hall.

VPA 604 VETERINARY PROTOZOOLOGY 2+1

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Practical

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

Suggested Readings

Bhatia BB & Shah HL. 2000. *Protozoa and Protozoan Diseases of Domestic Livestock*. ICAR.

Bhatia BB. 2000. *Textbook of Veterinary Protozoology*. ICAR.

Dobbelaere DAE & McKeever D. 2002. *Theileria*. Springer Verlag.

Dubey JP & Beattie CP.1988. *Toxoplasmosis of Animals and Man*. CRC Press.

Dubey JP, Speer CA & Fayer R. 1989. *Sarcocystosis of Animals and Man*. CRC Press.

Dubey JP, Speer CA & Fayer R. 1990. *Cryptosporidiosis in Man and Animals*. CRC Press.

Kreier JP. 1991-95. *Parasitic Protozoa*. Ed. JR Baker. Academic Press.

Levine ND. 1985. *Veterinary Protozoology*. Iowa State Univ. Press.

Lindsay DS & Weiss LM. 2004. *Opportunistic Infections* :*Toxoplasma Sarcocystis and Microsporidia*. Kluwer Academic Press.

Maudlin I. 2004. *The Trypanosomiases*. Oxford Univ. Press.

Sterling CR. and Adam RD. 2004. *The Pathogenic Enteric Protozoa*. Kluwer Academic Press.

Thompson A. 2003. *Cryptosporidium*. Elsevier

VPA 605 PARASITOLOGICAL TECHNIQUES 0+2

Objective

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

Practical

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

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

Evaluation of the efficacy and resistance of drugs against parasites.

Maintenance of tick and fly colonies in laboratory for experimental purposes and testing of drugs; tick dissection for vector potential.

Collection of aquatic snails from field and their examination for the presence of different parasitic stages.

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

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

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

Suggested Readings

Chaudhri SS & Gupta SK. 2003. *Manual of General Veterinary Parasitology*. International Book Distr. Co.

Durr P & Gatrell A. 2004. *GIS and Spatial Analysis in Veterinary Science*. CABI.

Ministry of Aghriculture, Fisheries and Food (MAFF). 1986. *Manual of Veterinary Parasitological Laboratory Techniques*. 3rd Ed. Tech. Bull. 18, HMSO.

Rathore VS & Sengar YS. 2005. *Diagnostic Parasitology*. Pointer Publ.

VPA 606 CLINICAL PARASITOLOGY 1+1

Objective

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

Theory

UNIT I

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

UNIT II

Collection and dispatch of material to laboratory for diagnosis.

UNIT III

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

Practical

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

Suggested Readings

Faust EC, Russell PF & Jung RC. 1971. *Craig and Faust's Clinical Parasitology*. Lea & Febiger.

Sloss MW, Kemp RL & Zajac AM. 1994. *Veterinary Clinical Parasitology*. Indian Ed. International Book Distr. Co.

Soulsby EJL. 1965. *Textbook of Veterinary Clinical Parasitology*. Blackwell.

VPA 607 TRENDS IN CONTROL OF LIVESTOCK AND POULTRY PARASITES 1+1

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

Practical

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

Suggested Readings

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

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

VPA 608 IMMUNOPARASITOLOGY 2+1

Objective

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

Theory

UNIT I

Introduction, types of parasitic antigens and their characterization.

UNIT II

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

UNIT III

Evasion of immunity, immumomodulations and their uses.

UNIT IV

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

UNIT V

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

UNIT VI

Vaccines and vaccination against parasitic infections.

UNIT VII

Genetic control of parasites.

Practical

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

Suggested Readings

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

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

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

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

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

Parasitology. Wileyliss Publication, New York.

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

VPA 609 PARASITIC ZOONOSES 2+0

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

Suggested Readings

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

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

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

Rathore VS.2005. *Parasitic Zoonoses*. Pointer Publishers.

Shakespeare M. 2002. *Zoonoses*. Pharmaceutical Press.

University Press.

VPA 610 PARASITES OF ZOO AND WILD ANIMALS 2+1

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

Practical

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

Suggested Readings

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

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

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

Oxford & IBH Publishing Co. Pvt. Ltd.

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

VPA 611 MALACOLOGY 1+1

Objective

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

Theory

UNIT I

Characters and classification of Mollusca.

UNIT II

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

Unit III

Examination of vector molluscs for parasitic infections.

Unit IV

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

Practical

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

Suggested Readings

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

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

VPA 701 APPLICATIONS OF REMOTE SENSING AND GEOGRAPHIC INFORMATION SYSTEM IN PARASITOLOGY 1+2

Objective

To study the emerging applications of Remote Sensing and Geographic Information System in parasitology.

Theory

UNIT I

Basic principles of Remote Sensing, satellite and imagery sensor systems, spectral signatures, interpretation of satellite imagery, digital image processing.

UNIT II

Fundamentals of GIS, raster data representation, vector data representation, GIS data management, data input, editing, analysis and modeling. GIS output as maps.

UNIT III

Integration of RS and GIS. Applications of RS and GIS in parasitology, case studies related to vector and vector-borne parasitic diseases, soil transmitted helminths.

Practical

Understanding maps and map projections, maps as models. IRS data products, visual interpretation of image, Digital image processing, contrast

enhancements, spatial filtering techniques, image transformations, image classification. Applications of Remote Sensing in parasitology. Components of GIS, creation of digital database in a GIS, GIS operations, data analysis and modeling. Case studies of applications of GIS in parasitology. Application of GIS in modeling the spatial and temporal spread of parasites. Global Positioning System (GPS), its applications and hands-on practice. Hands-on practice on RS and GIS software's like ERDAS Imagine, ArcGIS, ILWIS etc. Internet as resource for RS data products.

Suggested Readings

Selected articles from journals

VPA 702 MOLECULAR DIAGNOSTICS AND VACCINE DEVELOPMENT IN PARASITOLOGY 2+1

Objective

To understand the molecular analysis of parasites for diagnosis, disease control, drug development and vaccine production.

Theory

UNIT I

Introduction and parasite genomics.

UNIT II

DNA and RNA technology, Gene expression and regulation.

UNIT III

Recombinant protein production.

UNIT IV

Hybridoma technology and its application in parasitology.

UNIT VI

Molecular diagnosis and Phylogeny. Expression of antigens and antibody fragments useful as diagnostic reagents and vaccines. Restriction Fragment Length Polymorphism (RFLP), Polymerase Chain Reaction, modified PCR and related techniques, Random Amplified Polymorphic DNA (RAPD), Nucleic acid probe and Cleavage Length Fragment Polymorphism (CFLP).

UNIT VII

Types of immune responses produced by various parasites, novel and other antigens, proteases and cytokines in vaccine production.

UNIT VIII

Nucleic acid vaccines. Vectored parasitic vaccines.

Practical

Identification, characterization, and purification of antigens, analysis of parasite protein antigens, preparation of polyclonal antibodies. RAPD, RFLP, PCR, modified PCR and related techniques. DNA and RNA isolation protocols from blood, tissues and parasites and immuno- assays for studying the vaccine response.

Suggested Readings

Selected articles from journals.

VPA 703 HOST PARASITE INTERACTIONS 2+0

Objective

To understand the importance of host-parasite interactions.

Theory

UNIT I

Introduction, distribution of parasites on/in the host, morphological specializations for life on the host.

UNIT II

Behavioural defenses, host immune responses and genetic resistance to parasites.

UNIT III

Establishment of parasites in immuno-competent, susceptible, intermediate and abnormal hosts, chronicity of parasitic infections, immuno-evasive strategies of the parasites, host-parasite equilibrium.

UNIT IV

Pathology of host parasite interactions, host parasite interactions in relation to malnutrition and micronutrient metabolism.

Suggested Readings

Selected articles from journals.

VPA 704 ADVANCES IN PROTOZOOLOGY 2+1

Objective

To discuss the latest scientific developments on various aspects of protozoan parasites.

Theory

UNIT I

Advanced studies on taxonomy, molecular biology, pathogenesis, immunology and serology of intestinal protozoa.

UNIT II

Advanced studies on taxonomy, molecular biology, pathogenesis, immunology and serology of haemoprotozoans.

UNIT III

Advanced studies on taxonomy, molecular biology, pathogenesis, immunology and serology of tissue and other protozoa

Practical

Morphological, pathological and immunodiagnostic studies on various protozoan parasites.

Suggested Readings

Selected articles from journals.

VPA 705 ADVANCES IN HELMINTHOLOGY – I 2+1

Objective

To discuss the latest scientific developments on various aspects of trematodes and cestodes.

Theory

UNIT I

Advanced studies on taxonomy, molecular biology, pathogenesis, immunology and serology of trematodes and their larval stages.

UNIT II

Advanced studies on taxonomy, molecular biology, pathogenesis, immunology and serology of cestodes and metacestodes.

Practical

Morphological, pathological and immunodiagnostic studies on various trematodes and cestodes.

Suggested Readings

Selected articles from journals.

VPA 706 ADVANCES IN HELMINTHOLOGY – II 2+1

Objective

To discuss the latest scientific developments on various aspects of nematodes and thorny-headed worms.

Theory

UNIT I

Advanced studies on taxonomy, molecular biology, pathogenesis, immunology and serology of nematodes and their larval stages.

UNIT II

Advanced studies on taxonomy, molecular biology, pathogenesis, immunology and serology of thorny-headed worms.

Practical

Morphological, pathological and immunodiagnostic studies on various nematodes and thorny-headed worms.

Suggested Readings

Selected articles from journals.

VPA 707 ADVANCES IN ENTOMOLOGY AND ACAROLOGY 2+1

Objective

To discuss latest scientific developments on various aspects of arthropods.

Theory

UNIT I

Origin, evolution, regional and seasonal distribution, forecasting insect and acarine population through biological modelling.

UNIT II

Population dynamics of insects and acarines in relation to biotic and abiotic factors.

UNIT III

Recent developments pertaining to insects of veterinary importance.

UNIT IV

Recent developments pertaining to arachnids of veterinary importance.

UNIT V

Chemical, biological, immunological control measures and in-depth study of integrated pest management. Modulation of vector competence to transmit parasitic infections using molecular genetics by developing transgenic vectors.

Practical

Identification of arthropods of veterinary importance in the region. Dissection of arthropods for recovery of infective stages of parasites. Immunopathological changes in the host tissues due to haemato-phagous arthropods.

Suggested Readings

Selected articles from journals.

VPA 708 *IN VITRO* CULTIVATION OF PARASITES 1+2

Objective

Development of skills for cultivation of various parasites in the laboratory for research and practical control.

Theory

UNIT I

Introduction, problems and goals.

UNIT II

In vitro cultivation of genital flagellates, intestinal flagellates and intestinal ciliates.

UNIT III

In vitro cultivation of intestinal and tissue protozoa.

UNIT IV

In vitro cultivation of haemoprotozoans.

UNIT V

In vitro techniques, media and tissue culture for cultivation of helminths and their larval stages.

UNIT VI

In vitro mass rearing and colonization of ticks, flies and other insects**.**

Practical

Preparation of media and cultivation of important parasites, raising and maintenance of cell-lines of important parasites.

Suggested Readings

Selected articles from journals.

VPA 709 EMERGING AND RE-EMERGING PARASITIC DISEASES 2+0

Objective

To study the emerging and re-emerging parasitic diseases.

Theory

UNIT I

Emerging and re-emerging helminthic diseases.

UNIT II

Emerging and re-emerging protozoan diseases.

UNIT III

Emerging and re-emerging vector-borne diseases.

Suggested Readings

Selected articles from journals.

VPA 710 BIONOMICS OF PARASITES 3+0

Objective

To study ultrastructure, physiology, biochemistry and bionomics of important parasites.

Theory

UNIT I

Ultrastructure, physiology, biochemistry and bionomics of trematodes and cestodes of veterinary importance.

UNIT II

Ultrastructure, physiology, biochemistry and bionomics of nematodes of veterinary importance.

UNIT III

Ultrastructure, physiology, biochemistry and bionomics of important arthropod parasites.

UNIT IV

Ultrastructure, physiology, biochemistry and bionomics of important protozoan parasites.

Suggested Readings

Selected articles from journals.

VPA 711 ENVIRONMENTAL PARASITOLOGY 1+1

Objective

To study the effect of environmental changes and ecological disturbances on the emergence, proliferation and transmission of parasitic diseases.

Theory

UNIT I

Environmental changes and ecological disturbances due to natural phenomenon and human interventions (demographic, societal and agricultural changes, global warming, floods, hurricanes and pollution etc.).

UNIT II

Effect of environmental changes and ecological disturbances on the proliferation and transmission of helminthic diseases

UNIT III

Effect of environmental changes and ecological disturbances on the proliferation and transmission of protozoan diseases.

UNIT IV

Effect of environmental changes and ecological disturbances on the proliferation of intermediate hosts and vectors and their role in transmission of diseases.

Practical

Examination of water, soil, meat and vegetables etc. to record the contamination with parasites due to environmental changes. Assessment of effect of temperature and humidity on the development of parasites. Use of Process-based (mathematical) models to express the scientifically documented relationship between climatic variables and biological parameters e.g., vector breeding, survival and biting rates; parasite incubation rates.

Suggested Readings

Selected articles from journals.

VPA 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 PARASITOLOGY

List of Journals

* Advances in Parasitology
* Trends in Parasitology
* Veterinary Parasitology
* International Journal for Parasitology
* Journal of Helminthology
* Journal of Parasitic Diseases
* Journal of Protozoology
* Journal of Protozoology Research
* Journal of Veterinary Parasitology
* Medical and Veterinary Entomology
* Parasitology
* Parasitology International
* Experimental Parasitology

e-Resources

* http://www.sciencedirect.com/science/journal/03044017 (Veterinary. Parasitology)
* http://www.sciencedirect.com/science/journal/14714922 (Trends in Parasitology)
* http://www.sciencedirect.com/science/journal/00207519 (International Journal for Parasitology)
* http://www.sciencedirect.com/science/journal/13835769 (Parasitology International)
* http://www.sciencedirect.com/science/journal/00144894(Experimental Parasitology)
* http://journals. Cambridge.org (Parasitology)
* http://asp.unl.edu (Journal of Parasitology)
* http://www.bentham.org/open/toparaj (The open Parasitology Journal)
* http://www.springer.com/biomed/medical+microbiology)Journal/436 (Parasitology Research)
* http://parasitologyindia.org (Journal of Parasitic Diseases)
* http://www.waap.org (World Assoc. for Advancement of Vety. Parasitology)

Suggested Broad Topics for Master's and Doctoral Research

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

VETERINARY PATHOLOGY

Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
VPP 601	GENERAL PATHOLOGY	2+1
VPP 602	TECHNIQUES IN PATHOLOGY	1+1
VPP 603	ANIMAL ONCOLOGY	1+1
VPP 604	CLINICAL PATHOLOGY	1+2
VPP 605	NECROPSY PROCEDURES AND INTERPRETATIONS –I	0+1
VPP 606	NECROPSY PROCEDURES AND INTERPRETATIONS –II	0+1
VPP 607	SYSTEMIC PATHOLOGY	2+1
VPP 608	PATHOLOGY OF INFECTIOUS DISEASES OF DOMESTIC ANIMALS	2+1
VPP 609	TOXICOPATHOLOGY	2+1
VPP 610	AVIAN PATHOLOGY	2+1
VPP 611	PATHOLOGY OF LABORATORY ANIMALS, FISH AND WILD ANIMALS	2+1
VPP 612	VETEROLEGAL PATHOLOGY	1+0
VPP 691	MASTER'S SEMINAR	1+0
VPP 699	MASTER'S RESEARCH	20
VPP 701	PATHOLOGY OF NUTRITIONAL AND METABOLIC DISTURBANCES	2+1
VPP 702	ADVANCES IN TOXICOPATHOLOGY	2+1
VPP 703	ADVANCES IN DIAGNOSTIC PATHOLOGY	1+2
VPP 704	ULTRASTRUCTURAL PATHOLOGY	1+1
VPP 705	IMMUNOPATHOLOGY	2+1
VPP 706	PATHOLOGY OF IMPORTANT AND EMERGING DISEASES OF PETS AND LIVESTOCK	1+1
VPP 707	ADVANCES IN AVIAN PATHOLOGY	2+1
VPP 708	PATHOLOGY OF FUNGAL DISEASES	2+1
VPP 709	MOLECULAR PATHOLOGY OF CELL INJURY	2+1
VPP 710	EXPERIMENTAL PATHOLOGY	1+1
VPP 790	SPECIAL PROBLEM	0+2
VPP 791	DOCTORAL SEMINAR I	1+0
VPP 792	DOCTORAL SEMINAR II	1+0
VPP 799	DOCTORAL RESEARCH	45

VETERINARY PATHOLOGY
Course Contents

VPP 601 GENERAL PATHOLOGY 2+1

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

Circulatory and growth disturbances. Reversible and irreversible cell injury.

UNIT IV

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

Practical

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

Suggested Readings

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

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

VPP 602 TECHNIQUES IN PATHOLOGY 1+1

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

Practical

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

Suggested Readings

Culling CFA. 1969. *Handbook of Histological Techniques*. Butter Worths.

Lillie RD. 1965. *Histopathologic Techniques and Practical Histo-chemistry*. 3rd Ed. McGraw-Hill.

VPP 603 ANIMAL ONCOLOGY 1+1

Objective

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

Theory

UNIT I

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

UNIT II

Etiology, histogenesis and experimental production.

UNIT III

Tumour immunology, cell cultures, transplantation and biological behaviour.

Practical

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

Suggested Readings

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

VPP 604 CLINICAL PATHOLOGY 1+2

Objective

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

Theory

UNIT I

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

UNIT II

Exfoliative cytology, organ function tests and their interpretation.

UNIT III

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

Practical

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

Suggested Readings

Benzamin MM. 1978. *Outline of Veterinary Clinical Pathology*. 3rd Ed. Iowa State Univ. Press.

Coles EH. 1967. *Veterinary Clinical Pathology*. WB Saunders.

VPP 605 NECROPSY PROCEDURES AND INTERPRETATIONS-1 0+1

Objective

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

Practical

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

Suggested Readings

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

VPP 606 NECROPSY PROCEDURES AND INTERPRETATIONS-II 0+1

Objective

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

Practical

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

Suggested Readings

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

VPP 607 SYSTEMIC PATHOLOGY 2+1

Objective

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

Theory

UNIT I

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

UNIT II

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

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

UNIT III

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

Practical

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

Suggested Readings

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

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

Objective

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

Theory

UNIT I

Pathology of various viral diseases of domestic animals.

UNIT II

Pathology of various bacterial and fungal diseases of domestic animals.

UNIT III

Pathology of various rickettsial and parasitic diseases of domestic animals.

Practical

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

Suggested Readings

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

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

VPP 609 TOXICOPATHOLOGY 2+1

Objective

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

Theory

UNIT I

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

UNIT II

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

Practical

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

Suggested Readings

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

VPP 610 AVIAN PATHOLOGY 2+1

Objective

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

Theory

UNIT I

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

UNIT II

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

Practical

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

Suggested Readings

Calnek BW. 1991. *Diseases of Poultry*. 9th Ed. Iowa State Univ. Press.

Saif YM, Barnes FJ, Glisson JR, Fadly AM, Mc Dougald LR & Swayne D. 2008. *Diseases of Poultry*. 11th Ed. Blackwell Publishing.

VPP 611 PATHOLOGY OF LABORATORY ANIMALS, FISH AND WILD ANIMALS 2+1

Objective

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

Theory

UNIT I

Introduction, disease transmission and inter-phase.

UNIT II

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

UNIT III

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

Practical

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

Suggested Readings

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

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

VPP 612 VETEROLEGAL PATHOLOGY 1+0

Objective

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

Theory

UNIT1

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

UNIT II

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

UNIT III

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

Suggested Readings

Gahlot AK, Sharma SN & Tanwar RA. 2003. *Veterinary Jurisprudence*. 5th Ed. NBS Publishers, Bikaner.
Jones TC & Gleiser CA. 1954. *Veterinary Necropsy Procedures*. JB Lippincott.
Lincoln PJ & Thomson J. 1998. *Forensic DNA Profiling Protocols*. Humana Press.
Rudin N & Inman K. 2002. *An Introduction to Forensic DNA Analysis*. CRC Press.

VPP 701 PATHOLOGY OF NUTRITIONAL AND METABOLIC DISTURBANCES 2+1

Objective

To teach students about nutritional and metabolic disorders of livestock.

Theory

UNIT I

Pathogenesis, gross and microscopic pathology of nutritional deficiencies viz. carbohydrate, protein, fats, vitamins and macro and microelements and their imbalances.

UNIT II

Different metabolic diseases namely milk fever, ketosis, tetany, azoturia. Downer's cow syndrome and post parturient hemoglobinuria in domestic animals.

Practical

Estimation of certain minerals in sera of natural and experimentally induced deficiencies in domestic animals. To study the haematological, gross and microscopic pathological alterations caused by nutritional and metabolic disorders.

Suggested Readings

Selected articles from journals.

VPP 702 ADVANCES IN TOXICOPATHOLOGY 2+1

Objective

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

Theory

UNIT I

Introduction, mode of action, diagnosis and treatment of different poisons and their classification. Experimental animal models for toxicity studies and evaluation of parameters.

UNIT II

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

Practical

Clinico-pathological studies on natural or experimentally induced toxicity /poisoning in domestic animals. To study gross and histopathological alterations as a result of ingestion of toxic plants and extraneous poisons in domestic animals.

Suggested Readings

Selected articles from journals.

VPP 703 ADVANCES IN DIAGNOSTIC PATHOLOGY 1+2

Objective

To teach current diagnostic techniques for diagnosis of different diseases.

Theory

UNIT I

Study of the principles of biopsy techniques and electron microscopy.

UNIT II

Current techniques for diagnosis of diseases.

Practical

Principles and practice of fluorescent and phase contrast microscopy, chromatography, spectrophotometery and immunodiffusion technique, use of laboratory animals, chick embryos etc. for the diagnosis of animal diseases.

Suggested Readings

Selected articles from journals.

VPP 704 ULTRASTRUCTURAL PATHOLOGY 1+1

Objective

To study the significance of ultra-structural changes in organelles.

Theory

UNIT I

Study of cells- cell morphology, interpretation of normal and abnormal cells.

UNIT II

Study of cell organelles, degenerations, infiltrations, viral inclusions.

Practical

Study of EM photographs, collection and preparation of specimens for EM studies.

Suggested Readings

Selected articles from journals.

VPP 705 IMMUNOPATHOLOGY 2+1

Objective

To teach students immunologically mediated and autoimmune diseases of livestock.

Theory

UNIT I

Principles of immunopathology, hypersensitivity status, pathology of immune complex diseases.

UNIT II

Immunoproliferative disorders, autoimmune diseases and immune deficiencies in man and domestic animals.

Practical

Immune complexes, quantification and determination by various techniques, enumeration of various populations of lymphocytes by different techniques, determination of C3 levels, autoimmune reaction by demonstrating autoantibodies, hypersensitivity reactions (class IV and others).

Suggested Readings

Selected articles from journals.

VPP 706 PATHOLOGY OF IMPORTANT AND EMERGING DISEASES OF PETS AND LIVESTOCK 1+1

Objective

To teach students important and emerging diseases of pets and livestock.

Theory

UNIT I

Introduction to emerging diseases, foot and mouth disease, vesicular stomatitis, vesicular exanthema, rinderpest/Peste des petits ruminants, para influenza -3, infectious bovine rhinotracheitis/infectious pustular vulvovaginitis, bovine spongiform encephalopathy, scrapie, blue tongue, malignant catarrhal fever, mucosal disease/bovine viral diarrhoea, bovine leucosis.

UNIT II

Tuberculosis/Johne's disease, brucellosis, listeriosis, caprine arthritis, campytobacteriosis, encephalitis, parvovirus infection, emerging diseases of pets.

Practical

Study of clinical and gross alterations and histopathology of some important emerging and enzootic diseases.

Suggested Readings

Selected articles from journals.

VPP 707 ADVANCES IN AVIAN PATHOLOGY 2+1

Objective

To teach different diagnostic techniques for diagnosis of different avian diseases.

Theory

UNIT I

Advances in pathogenesis and pathology including molecular basis of important infections (bacterial, viral, fungal and parasitic).

UNIT II

Non-infectious diseases with particular emphasis on emerging diseases of chickens, turkeys, ducks and other birds.

Practical

Necropsy examination of different species of poultry. Study of gross and microscopic lesions in natural and experimentally produced diseases in different species of birds. Diagnosis of different diseases of poultry.

Suggested Readings

Selected articles from journals.

VPP 708 PATHOLOGY OF FUNGAL DISEASES 2+1

Objective

To teach the diseases caused by different fungi and mycotoxins in animals.

Theory

UNIT I

Pathology of diseases associated with pathogenic fungi like aspergillosis, candidiasis, epizootic lymphangitis, histoplasmosis, coccidioidomycosis, cryptococcosis, bovine abortions, dermatophytomycosis etc.

UNIT II

Diseases associated with mycotoxins like aflatoxins, rubratoxin, T_2 toxin, ochratoxin etc. Metabolism of toxins and their effect in man, domestic and laboratory animals, poultry and aquatic species.

Practical

Demonstration of pathogenic mycotoxic fungi, chemistry of toxic compounds, physical and chemical properties, methods of extraction, isolation and identification of mycotoxins.

Suggested Readings

Selected articles from journals.

VPP 709 MOLECULAR PATHOLOGY OF CELL INJURY 2+1

Objective

To acquaint the students about the molecular basis of cell injury and inflammation.

Theory

UNIT I

Causes of cell injury - Ischemic, Hypoxic, Free radicals, virus and chemical cell injury - Chemical Mediators - Cytoskeletal and biochemical changes in cell injury.

UNIT II

Ultrastructural changes and biochemical mechanisms of reversible injury, necrosis, apoptosis. Molecular basis of disease. Cellular adaptation-hyperplasia, hypertrophy, atrophy, metaplasia and dysplasia. Intracellular accumulations.

UNIT III

Inflammation- mechanism and types. Tissue repair and healing.

Practical

Gross and histopathological studies pertaining to above conditions.

Suggested Readings

Selected articles from journals.

VPP 710 EXPERIMENTAL PATHOLOGY 1+1

Objective

To provide expertise in designing the experiments and handling of animals.

Theory

UNIT I

Need for experimentation in research, animal experimentation techniques, preparation of experimental protocols, biochemical studies, pathological examination of clinical samples.

UNIT II

Transplantation techniques, immune regulation, tissue culture, blood cell separation protocols, electrophoresis and chromatography, study of animal model and designing of experiment.

Practical

Short research problems involving contemporary issues and research techniques.

Suggested Readings

Selected articles from journals.

VPP 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 PATHOLOGY

List of Journals

* Advances in Veterinary Sciences
* American Journal of Veterinary Medical Association
* Avian Diseases
* Current Contents
* Indian Journal of Animal Sciences
* Indian Journal of Poultry Science
* Indian Journal of Veterinary Pathology
* Journal of Immunology and Immunopathology
* Veterinary Bulletin
* Veterinary Pathology

e-Resources

* www.iavp.org (Indian Journal of Veterinary Pathology)
* www.vetpathology.org (Veterinary Pathology)
* www.tandf.co.uk (Avian Pathology)
* www.avdi.allenpress.com (Avian Diseases)
* www.elsevier.com/locate/vetimm (Veterinary Immunology and Immuno-pathology)

Suggested Broad Topics for Master's and Doctoral Research

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

VETERINARY PHARMACOLOGY AND TOXICOLOGY

Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
VPT 601	GENERAL PHARMACOLOGY	2+0
VPT 602	AUTONOMIC AND AUTACOID PHARMACOLOGY	2+1
VPT 603	CNS PHARMACOLOGY	2+1
VPT 604	DIGESTIVE AND RESPIRATORY PHARMACOLOGY	2+0
VPT 605	CARDIOVASCULAR AND RENAL PHARMACOLOGY	2+0
VPT 606	ENDOCRINE AND REPRODUCTIVE PHARMACOLOGY	2+0
VPT 607	CHEMOTHERAPY	2+1
VPT 608	TOXICOLOGY OF XENOBIOTICS	2+1
VPT 609	TOXICOLOGY OF PLANTS AND TOXINS	2+0
VPT 610	PHARMACOLOGICAL TECHNIQUES	1+1
VPT 611	TECHNIQUES IN TOXICOLOGY	1+1
VPT 612	ETHNOPHARMACOLOGY	2+0
VPT 691	MASTER'S SEMINAR	1+0
VPT 699	MASTER'S RESEARCH	20
VPT 701	ADVANCES IN NEUROPHARMACOLOGY	2+0
VPT 702	AUTACOID PHARMACOLOGY	1+0
VPT 703	PHARMACOLOGY OF HERBAL DRUGS	2+1
VPT 704	DRUG METABOLISM	2+0
VPT 705	MOLECULAR PHARMACOLOGY	2+0
VPT 706	PHARMACOKINETICS	2+1
VPT 707	PHARMACOGENOMICS	2+0
VPT 708	IMMUNOPHARMACOLOGY	1+0
VPT 709	MOLECULAR TOXICOLOGY	2+0
VPT 710	CLINICAL PHARMACOLOGY	1+1
VPT 711	CLINICAL TOXICOLOGY	2+1
VPT 712	ECOTOXICOLOGY	2+0
VPT 713	REGULATORY TOXICOLOGY	2+1
VPT 790	SPECIAL PROBLEM	0+2
VPT 791	DOCTORAL SEMINAR I	1+0
VPT 792	DOCTORAL SEMINAR II	1+0
VPT 799	DOCTORAL RESEARCH	45

VETERINARY PHARMACOLOGY AND TOXICOLOGY

Course Contents

VPT 601 GENERAL PHARMACOLOGY 2+0

Objective

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

Theory

UNIT I

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

UNIT II

Important pharmacokinetic parameters and their clinical significance.

UNIT III

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

UNIT IV

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

Suggested Readings

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

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

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

VPT 602 AUTONOMIC AND AUTACOID PHARMACOLOGY 2+1

Objective

To study the pharmacodynamics of autonomic drugs.

Theory

UNIT I

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

UNIT II

Neurohumoral transmission in ANS.

UNIT III

Pharmacology of cholinergic agonists and antagonists.

UNIT IV

Pharmacology of adrenergic agonists and antagonists.

UNIT V

Ganglionic stimulants and blockers.

UNIT VI

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

Practical

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

Suggested Readings

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

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

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

VPT 603 CNS PHARMACOLOGY 2+1

Objective

To study the pharmacodynamics of drugs acting on CNS.

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

Practical

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

Suggested Readings

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

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

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

VPT 604 DIGESTIVE AND RESPIRATORY PHARMACOLOGY 2+0

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

Gastrointestinal protectants and adsorbents, laxatives and cathartics.

UNIT IV

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

UNIT V

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

UNIT VI

Bronchodilators, antitussives, mucolytics, expectorants, decongestants.

UNIT VII

Drugs used in treatment of asthma.

Suggested Readings

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

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

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

VPT 605 CARDIOVASCULAR AND RENAL PHARMACOLOGY 2+0

Objective

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

Theory

UNIT I

Pharmacology of cardiac glycosides.

UNIT II

Antiarrhythmic, antihypertensive and antihyperlipidaemic drugs.

UNIT III

Drugs affecting vasomotor and cardiorespiratory reflex mechanisms and haemopoietic system.

UNIT IV

Coagulants and anticoagulants, thrombolytic agents.

UNIT V

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

UNIT VI

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

Suggested Readingss

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

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

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

VPT 606 ENDOCRINE AND REPRODUCTIVE PHARMACOLOGY 2+0

Objective

To study the pharmacology of drugs affecting endocrine functions.

Theory

UNIT I

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

UNIT II

Hormonal regulation of calcium and phosphorus homeostasis.

UNIT III

Pharmacology of drugs affecting male reproductive organs, spermatogenesis.

UNIT IV

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

UNIT V

Oxytocic and tocolytic drugs.

Suggested Readings

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

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

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

VPT 607 CHEMOTHERAPY 2+1

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

Penicillins, cephalosporins, beta-lactam antibiotics.

UNIT IV

Chloramphenicol, tetracyclines, macrolides, polymixins, polypeptides.

UNIT V

Aminoglycosides and other antibiotics.

UNIT VI

Anti-protozoans, anthelmintics, ectoparasiticides.

UNIT VII

Antituberculosis, antifungal, antiviral and antineoplastic drugs.

Practical

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

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

Suggested Readings

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

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

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

VPT 608 TOXICOLOGY OF XENOBIOTICS 2+1

Objective

To study the poisonings and their antidotal therapy in animals.

Theory

UNIT I

Principles and scope of toxicology, sources of poisoning.

UNIT II

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

UNIT III

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

UNIT IV

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

Practical

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

Suggested Readings

Klassen CD, Amdure MO & Doull J. (Eds). 1996. *Casarett & Doull's Toxicology: The Basic Sciences of Poisons*. 5th Ed. McGraw Hill.

Sandhu HS & Brar RS. 2000. *Text Book of Veterinary Toxicology*. 1st Ed. Kalyani Publishers.

Stive KE & Brown TM. 2006. *Principles of Toxicology*. 2nd Ed. CRC Press.

VPT 609 TOXICOLOGY OF PLANTS AND TOXINS 2+0

Objective

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

Theory

UNIT I

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

UNIT II

Plants producing lathyrism, thiamine deficiency and photosensitization.

UNIT III

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

UNIT IV

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

Suggested Readings

Chopra SR, Badhwar RL & Ghosh S. 1984. *Poisonous Plants of India*. 1st Ed., Academic Publishers, Jaipur.

Klassen CD, Amdure MO & Doull J. (Eds). 1996. *Casarett & Doull's Toxicology: Basic Sciences of Poisons*. 5th Ed., McGraw Hill.

Sandhu HS and Brar RS. 2000. *Text Book of Veterinary Toxicology*. 1st Ed., Kalyani Publishers.

VPT 610 PHARMACOLOGICAL TECHNIQUES 1+1

Objective

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

Theory

UNIT I

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

UNIT II

Techniques for setting up isolated and intact preparations.

UNIT III

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

Practical

Setting up of isolated and intact preparations, recording of BP in dog/rat, recording of ECG in rat, experiments on drug potentiation, antagonism and tachyphylaxis. Construction of dose-response plots, calculation of EC_{50}, dissociation rate constants, potency ratio, pA_x, pDx and pD'_x values.

Specific tests for evaluation of tranquillizing, hypnotic, analgesic, anti-convulsant, general and local anesthetic, muscle relaxant, anti-inflammatory, antipyretic, antiarrhythmic, antihypertensive, antihyperglycemic and anticholesterimic activities. Determination of potency ratio, median effective, toxic or lethal doses. Bioassay techniques.

Suggested Readings

Ghosh MN. (Ed). 2005. *Fundamentals of Experimental Pharmacology*. 3rd Ed. Hilton & Co.

Kulkarni SK (Ed). 2004. *Handbook of Experimental Pharmacology*. 3rd Ed. Vallabh Prakashan.

Laurance DR & Bacharach AL. (Ed). 1964. *Evaluation of Drug Activities: Pharmacometrics*. Vols. I, II. Academic Press.

Parmar NS & Shiv Prakash 2006. *Screening Methods in Pharmacology*. 1st Ed. Narosa.

Seth UK, Dadkar NK & Usha G Kamat (Eds). 1972. *Selected Topics in Experimental Pharmacology*. 1st Ed. Kothari Book Depot.

Tallarida RJ & Murray RB. 1987. *Manual of Pharmacologic Calculations*. 2nd Ed. Springer Verlag.

VPT 611 TECHNIQUES IN TOXICOLOGY 1+1

Objective

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

Theory

UNIT I

Animal models in toxicological studies.

UNIT II

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

UNIT III

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

UNIT IV

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

Practical

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

Suggested Readings

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

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

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

VPT 612 ETHNOPHARMACOLOGY 2+0

Objective

To impart the knowledge and importance of traditional Indian medicine.

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

Alternate systems of medicine in animals.

Suggested Readings

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

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

Bisset NG. (Ed). 1994. *Herbal Drugs and Phytopharmaceuticals*. CRC Press.

Chopra RN, Nayar SL & Chopra IC. (Eds.). 2002. *Glossary of Indian Medicinal Plants*. NISCAIR, CSIR, New Delhi.

Pushpangadan P, Nyman U & George V. (Eds). 1995. *Glimpses of Indian Ethnopharmacology*. TBGRI Publication.

Rastogi RP & Mehrotra BN (Eds). 1993-95. *Compendium of Indian Medicinal Plants*. Vols. I-IV. Publication and Information Directorate, New Delhi.

Tallarida RJ & Murray RB. 1987. *Manual of Pharmacologic Calculations*. 2nd Ed. Springer Verlag.

VPT 701 ADVANCES IN NEUROPHARMACOLOGY 2+0

Objective

To understand the underlying mechanisms of drug receptor interactions and its effects.

Theory

UNIT I

Definition, classification of receptors, molecular structure of receptors.

UNIT II

G-protein coupled, ligand gated-ion channel and tyrosine kinase-linked receptors.

UNIT III

Ligand binding study of receptors. Signal transduction system: introduction to signal transduction, receptor linked to ion channels.

UNIT IV

G-proteins, second messengers: phospholipases, phosphokinases, intracellular calcium, protein kinase-C, IP_3, diacylglycerol and cyclic nucleotides.

UNIT V

Signal transduction through protein tyrosine kinases. Receptors as pharmaceutical targets.

Suggested Readings

Selected articles from journals.

VPT 702 AUTACOID PHARMACOLOGY 1+0

Objective

To study the pharmacodynamics of autacoids.

Theory

UNIT I

Pharmacodynamics of histamine and antihistamines.

UNIT II

Pharmacodynamics of serotonin and its antagonists; eicosanoids, bradykinin, angiotensin, kallikrein and other kinins.

UNIT III

Platelet-activating factors, slow reacting substances.

UNIT IV

Putative neurohumoral transmission – purine nucleotides, peptides, amino acids and nitric oxide.

Suggested Readings

Selected articles from journals.

VPT 703 PHARMACOLOGY OF HERBAL DRUGS 2+1

Objective

To study the pharmacological, therapeutic and toxicological aspects of potential medicinal plants and herbal drugs.

Theory

UNIT I

Historical aspect, chemical constituents of medicinal plants and their classification.

UNIT II

Identification, collection, preservation, purification, isolation, standardization and clinical validation of bioactive molecules from vegetable sources.

UNIT III

Characterization of pharmacological, therapeutic and toxic effects of potential herbal drugs.

UNIT IV

Strategies for development of herbal drugs.

Practical

Extraction, detection, isolation and purifications of active chemical constituents from plant sources. Pharmacological effects of herbal drugs on intact and isolated preparations.

Suggested Readings

Selected articles from journals.

VPT 704 DRUG METABOLISM 2+0

Objective

To study the mechanisms and processes of drug biotransformation.

Theory

UNIT I

Mechanisms and processes of drug biotransformation.

UNIT II

Synthetic and non-synthetic pathways of drug metabolism.

UNIT III

Chemical, biological, genetic and environmental factors. Species variations affecting drug biotransformation mechanisms.

UNIT IV

Hepatic microsomal and non-microsomal enzyme systems.

UNIT V

Enzyme induction and inhibition.

Suggested Readings

Selected articles from journals.

VPT 705 MOLECULAR PHARMACOLOGY 2+0

Objective

To study the identification and characterization of receptors and drug receptors interactions.

Theory

UNIT I

Physicochemical properties of drugs, forces involved in binding of drugs to receptors.

UNIT II

Receptor conformation and configuration and structure activity relationship.

UNIT III

Theories of drug receptor interactions; analysis of dose response relationship and molecular mechanisms of drug actions.

UNIT IV

Methods of identification, isolation and characterization of receptors.

Suggested Readings

Selected articles from journals.

VPT 706 PHARMACOKINETICS 2+1

Objective

To study the absorption, distribution, biotransformation and excretion of drugs.

Theory

UNIT I

Routes of drug administration, factors modifying drug delivery; absorption, distribution, biotransformation and elimination.

UNIT II

Kinetics following single and multiple dosage; compartmental models of drug distribution, bioavailability, volume of distribution and protein binding of drugs.

UNIT III

Rates of absorption, distribution and elimination; absorption and elimination half-lives and rate of transfer of drugs between compartments.

UNIT IV

Renal clearance, dosage regimen; non-compartmental pharmacokinetic modeling.

UNIT V

Application of pharmacokinetic principles in therapeutics.

Practical

Analysis of pharmacokinetic data and determination of different pharmacokinetic parameters and bioavailability of drugs in normal and diseased animal models.

Suggested Readings

Selected articles from journals.

VPT 707 PHARMACOGENOMICS 2+0

Objective

To study the responses to drugs with respect to various aspects of genomics.

Theory

UNIT I

Introduction, species variations affecting drug responses, increased and decreased responsiveness to drug effects/toxicities & novel drug effects

UNIT II

Genetic polymorphism.

UNIT III

Gene therapy: gene transfer technology, viral vectors, natural delivery strategies.

UNIT IV

Drugs & gene therapy of inherited diseases, genetic repair and inactivation strategies; synthesis of therapeutic proteins and cancer gene therapy.

UNIT V

Role of bioinformatics in pharmacogenomics.

Suggested Readings

Selected articles from journals.

VPT 708 IMMUNOPHARMACOLOGY 1+0

Objective

To study the pharmacological control of immune system.

Theory

UNIT I

General aspect of immune system, chemical mediators of immune system.

UNIT II

Pharmacological control of immune responses. Immunomodulators; immunostimulants, immunosuppressant and tolerogens; immunological basis of drug allergy and drug tolerance.

UNIT III

Interaction of nervous system, endocrine system and immune system, immunotoxic effects of environmental and other pollutants.

UNIT IV

Xenobiotic-induced immune dysfunctions and immune deficiencies; autoimmune reactions to xenobiotics, immunoregulants and their therapeutic applications in asthma, arthritis, cancer, dermatology and organ transplant etc.

Suggested Readings

Selected articles from journals.

VPT 709 MOLECULAR TOXICOLOGY 2+0

Objective

To understand the mechanisms & targets of cellular/ molecular toxicity

Theory

UNIT I

Cellular, subcellular and molecular targets of toxicity; mechanisms of toxicities.

UNIT II

Factors affecting toxicity, interactions of toxicants with target molecules.

UNIT III

Cellular dysfunctions, repair and dysrepair.

UNIT IV

Target organ directed toxicological effects of xenobiotics, detoxification, risk assessment.

UNIT V

Mechanism of chemical mutagenesis, carcinogenesis, teratogenesis and radiation toxicity.

Suggested Readings

Selected articles from journals.

VPT 710 CLINICAL PHARMACOLOGY 1+1

Objective

To study the clinical pharmacological aspects of drugs.

Theory

UNIT I

Scope of clinical pharmacology.

UNIT II

Drug discovery and clinical trials. Pharmacovigilance. Pharmacoepidemiology and pharmacoeconomics.

UNIT III

PK-PD relationship and its applications. Drug interactions and adverse drug reactions.

UNIT IV

Therapeutic drug monitoring. Rationale of drug use, drug regulations and acts.

Practical

Study on drug interactions and drug levels in diseased conditions. Study on plasma drug concentration-time profile and establishment of various pharmacokinetic parameters. Dosage adjustment in diseased conditions. Clinical trials of various drugs.

Suggested Readings

Selected articles from journals.

VPT 711 CLINICAL TOXICOLOGY 2+1

Objective

To study the scope of clinical toxicology and management of poisonings including regulatory and forensic toxicology.

Theory

UNIT I

Scope of clinical toxicology. Toxicological investigation and management of poisonings.

UNIT II

Target organ directed toxicity, Antidotal therapy.

UNIT III

Clinical aspect of poisoning due to specific toxicants viz. metals, pesticides, mycotoxins, animal and bacterial toxins, solvents and vapours, drugs and other food/feed contaminants.

UNIT IV

Forensic and analytical toxicology.

Practical

Demonstration of poisonings and their antidotal treatment; use of biomarkers in the assessment of toxicity. GLP evaluation, analysis of poisons in biological samples.

Suggested Readings

Selected articles from journals.

VPT 712 ECOTOXICOLOGY 2+0

Objectives

To impart knowledge regarding ecotoxicology for conservation of healthy eco-system.

Theory

UNIT I

Basic principles of ecotoxicology. Sources of contamination and effects of pollutants on eco-health.

UNIT II

Chemical contamination of air, water, soil and food by major agricultural and industrial chemicals – pesticides, hydrocarbons and metals. Fate of chemicals in the environment and target species.

UNIT III

Marine and wildlife as monitors of environmental quality.

UNIT IV

Contamination control and approaches to rehabilitating damaged ecosystems.

Suggested Readings

Selected articles from journals.

VPT 713 REGULATORY TOXICOLOGY 2+1

Objectives

Introduction to general principles in toxicological risk assessment.

Theory

UNIT I

Principles of risk assessment. Test protocols for toxicity studies.

UNIT II

Interaction between toxicology and industry. Compounds under regulatory legislation demands. Regulatory essential dose levels in chemical risk assessment (NOEL, NOAEL, LOEL, LOAEL & AOEL).

UNIT III

Risk assessment in practice. Classification and marking/branding of chemicals. Monitoring/surveillance of chemicals. Exposure assessment and modeling.

UNIT IV

Quality control in safety research (GLP). Operation of product register.

Practical

Good laboratory practice in toxicological research. Screening procedures in regulatory toxicology. Mandatory toxicity testing protocols. Determination of ADI, NOEL, NOAEL, LOEL, LOAEL and AOEL.

Suggested Readings

Selected articles from journals.

VPT 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 PHARMACOLOGY AND TOXICOLOGY

List of Journals

* American Journal of Veterinary Research
* Annual Review of Pharmacology
* Annual Review of Pharmacology and Toxicology
* Drugs
* Environmental Toxicology and Pharmacology
* European Journal of Pharmacology
* Indian Journal of Pharmacology
* Journal of American Medical Association
* Journal of Ethnopharmacology
* Journal of Pharmacology and Experimental Therapeutics
* Journal of Veterinary Pharmacology and Therapeutics
* Pharmacological Reviews
* Pharmacology, Biochemistry and Behaviour
* Toxicology
* Toxicology and Applied Pharmacology
* Toxicology International
* Trends in Pharmacological Sciences
* Veterinary and Human Toxicology

e-Resources

* www.elsevier.com (Environmental Toxicology and Pharmacology)
* www.blackwellpublishing.com (Journal of Vet. Pharmacology & Therapeutics)
* www.elsevier.com (Comparative Biochem. & Physiol.-Part C: Toxicol. & Pharma.)
* www.clinicalneuropharm.com (Clinical Neuropharmacology)
* www.arjournals.annualreviews.org (Annual Review of Pharma. & Toxicology)
* www.aac.aron.org (Antimicrobial agents and chemotherapy)
* www.nature.com/big/in dex.html (British Journal of Pharmacology)
* www. dmd.aspetijournals.org. (Drug metabolismand disposition)
* http://jpet.aspetijournals.org (The Journal of Pharmacology & Experimental Therapeutics)
* http://modpharm (Molecular Pharmacology)
* http://Pharmet.org (Pharmacological Reviews)
* www.nature.com/tpj/index.html (The Pharmacogenomics Journal)
* www. informaworld.org (International Journal of Toxicology)
* www.toxici.oxfordjournals.org (Toxicological Science)

Suggested Broad Topics for Master's and Doctoral Research

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

VETERINARY PUBLIC HEALTH

Course Structure- at a Glance

CODE	COURSE TITLE	CREDITS
VPH 601	ELEMENTS OF VETERINARY PUBLIC HEALTH	1+1
VPH 602	BACTERIAL AND RICKETTSIAL AGENTS OF PUBLIC HEALTH SIGNIFICANCE	2+1
VPH 603	VIRAL, FUNGAL AND PARASITIC AGENTS OF PUBLIC HEALTH SIGNIFICANCE	2+1
VPH 604	ZOONOSES AND PUBLIC HEALTH	2+1
VPH 605	PRINCIPLES OF FOOD HYGIENE AND SAFETY	2+1
VPH 606	FOOD-BORNE INFECTIONS AND INTOXICATIONS	2+1
VPH 607	MEAT AND MILK HYGIENE	2+1
VPH 608	ENVIRONMENTAL POLLUTION AND SAFETY	3+1
VPH 609	FISH, FISH PRODUCTS AND SEAFOOD HYGIENE	1+1
VPH 610	BIOTERRORISM AND DISASTER MANAGEMENT	1+1
VPH 691	MASTER'S SEMINAR	1+0
VPH 699	MASTER'S RESEARCH	20
VPH 701	CURRENT TOPICS IN VETERINARY PUBLIC HEALTH	2+1
VPH 702	EMERGING AND REEMERGING ZOONOSES	2+1
VPH 703	QUALITY CONTROL OF ANIMAL FOOD PRODUCTS	2+1
VPH 704	OCCUPATIONAL HEALTH HAZARDS	2+1
VPH 705	DISPOSAL AND RECYCLING OF WASTE	2+1
VPH 706	BIOHAZARDS, BIOSECURITY AND DISASTER MANAGEMENT	2+0
VPH 707	FOOD PLANT SANITATION	2+1
VPH 708	ADVANCES IN ENVIRONMENTAL POLLUTION CONTROL	2+1
VPH 790	SPECIAL PROBLEM	0+2
VPH 791	DOCTORAL SEMINAR I	1+0
VPH 792	DOCTORAL SEMINAR II	1+0
VPH 799	DOCTORAL RESEARCH	45

VETERINARY PUBLIC HEALTH
Course Contents

VPH 601 ELEMENTS OF VETERINARY PUBLIC HEALTH 1+1

Objective

To acquaint students with basics of veterinary public health.

Theory

UNIT I

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

UNIT II

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

UNIT III

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

Practical

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

Suggested Readings

Schwabe CW. 1969. *Veterinary Medicine and Human Health*. Williams & Wilkins.

Sherikar AT, Bachchil VN & Thapliyal DC. 2004. *Textbook of Elements of Veterinary Public Health*. ICAR.

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

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

Practical

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

Suggested Readings

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

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

Objective

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

Practical

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

Suggested Readings

Ananthanarayan R & Panikar J. 1997. *Textbook of Microbiology*. Orient Longman.

Pathak KML. 1991. *Fundamentals of Parasitic Zoonoses*. Kalyani.

VPH 604 ZOONOSES AND PUBLIC HEALTH 2+1

Objective

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

Theory

UNIT I

Concept and classification of zoonoses; comprehensive description of etiology, host range, epidemiology, diagnosis and management of zoonotic diseases.

UNIT II

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

UNIT III

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

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

UNIT IV

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

Practical

Isolation and identification of zoonotic agents, diagnostic procedures of zoonotic diseases.

Suggested Readings

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

VPH 605 PRINCIPLES OF FOOD HYGIENE AND SAFETY 2+1

Objective

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

Theory

UNIT I

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

UNIT II

Food spoilage, safety and preservation methods.

UNIT III

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

UNIT IV

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

Practical

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

Suggested Readings

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

VPH 606 FOOD-BORNE INFECTIONS AND INTOXICATIONS 2+1

Objective

To impart knowledge about major illnesses due to foods.

Theory

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

Heavy metals, antibiotics, hormones etc. in food.

Practical

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

Suggested Readings

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

VPH 607 MEAT AND MILK HYGIENE 2+1

Objective

To educate regarding general methods of food hygiene.

Theory

UNIT I

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

UNIT II

Meat hygiene and public health, abattoir hygiene.

UNIT III

Milk hygiene and public health, in place cleaning.

UNIT IV

Egg, food legislation, meat and milk adulteration.

Practical

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

Suggested Readings

Gracey JF, Collins DS & Huey RJ. 1999. *Meat Hygiene*. WB Saunders.
WHO. 1962. *Milk Hygiene*. WHO.
Jay JM. 1996. *Modern Food Microbiology*. CBS.

VPH 608 ENVIRONMENTAL POLLUTION AND SAFETY 3+1

Objective

To impart education about pollutants in the environment and control.

Theory

UNIT I

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

UNIT II

Soil pollution, air pollution, water pollution and health.

UNIT III.

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

UNIT IV

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

UNIT V

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

Practical

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

Suggested Readings

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

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

Objective

To impart knowledge regarding fish hygiene and fish borne diseases

Theory

UNIT I

Fisheries and resources, fish preservation, hygienic quality control

UNIT II

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

UNIT III

Fish borne diseases in relation to human health.

Practical

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

Suggested Readings

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

VPH 610 BIOTERRORISM AND DISASTER MANAGEMENT 1+1

Objective

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

Theory

UNIT I:

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

UNIT II

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

UNIT III

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

UNIT IV

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

Practical

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

Suggested Readings

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

VPH 701 CURRENT TOPICS IN VETERINARY PUBLIC HEALTH 2+1

Objective

To acquaint with contemporary issues concerning VPH.

Theory

UNIT I

Contemporary status of Veterinary Public Health administration, organisation and functions of veterinary public health agencies in India and abroad.

UNIT II

Advanced studies on principles, diagnostic methods of emerging public health problems, advances in zoonotic diseases.

UNIT III

Role of biotechnology in food hygiene, Hazard Analysis Critical Control Point System (HACCP).

Practical

Special problems related to field investigations of outbreaks of food poisoning and zoonotic diseases in a community.

Suggested Readings

Selected articles from journals.

VPH 702 EMERGING AND RE-EMERGING ZOONOSES 2+1

Objective

To acquaint with emerging and re-emerging zoonotic diseases.

Theory

UNIT I

Concept of emerging and re-emerging zoonotic infections, international interests in zoonoses, measurement and economics of zoonoses, latest diagnostic and management planning for zoonoses.

UNIT II

Current challenges and strategies, euzoonoses, xenozoonoses, nosocomial zoonoses, newer zoonotic agents viz. cat-scratch disease, rat bite fever, Creutzfeld-Jacob disease, Ebola, Marburg, Lassa, Nipah, Menangle, Herpes B, SARS.

UNIT III

Simian and human immunodeficiency, bovine spongiform encephalopathy, hepatitis A & E, toro, H5N1 influenza virus; re-emerging zoonoses with

new pathology viz. neurocysticercosis, campylobacteriosis, rabies, Guillan-Barre Syndrome, tuberculosis.

Practical

Special problems related to emerging/re-emerging prevalent zoonotic diseases in India.

Suggested Readings

Selected articles from journals.

VPH 703 QUALITY CONTROL OF ANIMAL FOOD PRODUCTS 2+1

Objective

To provide expertise to student in food quality control.

Theory

UNIT I

Microorganisms influencing food quality and food safety, principles of microbiological quality control of foods.

UNIT II

Major food-borne pathogens and spoilage organisms; their significance in consumer safety.

UNIT III

Detection of microorganisms in foods of animal origin.

Practical

Special problems on microbiological quality of foods of animal origin; detection, enumeration and identification of important food-borne pathogens.

Suggested Readings

Selected articles from journals.

VPH 704 OCCUPATIONAL HEALTH HAZARDS 2+1

Objective

To acquaint with occupational health hazards

Theory

UNIT I

Health/diseases associated with various occupations

UNIT II

Transportation, spread, maintenance and control of diseases affecting various occupational groups in contact with animals and their public health significance

Practical

Diagnosis of various occupational diseases of public health significance, identification and characterization of causative agents

Suggested Readings

Selected articles from journals.

VPH 705 DISPOSAL AND RECYCLING OF WASTE 2+1

Objective

To educate about safe and economic disposal of waste.

Theory

UNIT I

Concept of ‘reduce, reuse and recycle’ in environmental management, role of holistic environmental biotechnology and microbial control of pollution.

UNIT II

Safe disposal of animal waste and food plant waste, utilization/recycling of livestock waste.

UNIT III

Pollutants due to sewage, sewage treatment systems, solid waste and its management.

Practical

To study the role of microorganisms and chemicals in degrading waste, to study the factors influencing biodegradation.

Suggested Readings

Selected articles from journals.

VPH 706 BIOHAZARDS, BIOSECURITY AND DISASTER MANAGEMENT 2+0

Objective

To update knowledge on biological hazards and their prevention.

Theory

UNIT I

Biohazards and bioterrorism: case studies.

UNIT II

Innovative biosecurity approaches.

UNIT III

Regulations for safety in laboratories, hospitals, biological plants.

UNIT IV

Case studies of natural and man made disasters. Approaches for management of disasters. Formation of teams/ groups. Equipments required for managing such disasters.

Suggested Readings

Goel SL. 2007. *Disaster Administration and Management: Text and Case Studies*. Deep & Deep Publ., New Delhi.

Pinnkowski J. (Ed.). 2008. *Disaster Management Handbook*. CRC Press, Boca Raton.

VPH 707 FOOD PLANT SANITATION 2+1

Objective

To impart basic knowledge of sanitation in food plants.

Theory

UNIT I

Importance and maintenance of abattoir and meat plant sanitation.

UNIT II

Dairy plant sanitation.

UNIT III

Food plant waste disposal.

Practical

Evaluation of sanitation and disinfection procedures in food plants, evaluation of efficacy of disinfectants.

Suggested Readings

Selected articles from journals.

VPH 708 ADVANCES IN ENVIRONMENTAL POLLUTION CONTROL 2+1

Objective

To update knowledge on modern environmental pollution problem and control.

Theory

UNIT I

Advanced studies on problems pertaining to environmental hygiene, air, soil and water pollution, disinfection procedures, impact of global environmental problems on human/animal health; ecophilosophy, environmental ethics and environmental economics, environmental conflicts and cooperation.

UNIT II

Environmental risks and management, environmental risk assessment and reporting, modern global information, surveillance and monitoring systems, decision making and public awareness.

UNIT III

International environmental management efforts, participatory international organizations and their selected programmes and selected legislations.

Practical

Detection and estimation of air, soil and water pollution; detection of pathogens in environmental sources.

Suggested Readings

Selected articles from journals.

VPH 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 PUBLIC HEALTH
List of Journals

* Abstracts on Hygiene and Communicable Diseases
* Applied and Environmental Microbiology
* Emerging Infectious Diseases
* Food Science and Technology Abstracts
* Journal of Food Protection
* Journal of Food Science and Technology
* Journal of Veterinary Public Health
* Letters in Applied Microbiology

e-Resources

* www.who.int/zoonoses/vph/en (W.H.O. website related to Zoonotic diseases)
* www.fao.org (Website of Food and Agriculture Organization)
* www.cdc.gov (website of CDC publications)

Suggested Broad Topics for Master's and Doctoral Research

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

COMPULSORY NON-CREDIT COURSES

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

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

Course Contents

PGS 501 LIBRARY AND INFORMATION SERVICES 0+1

Objective

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

Practical

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

PGS 502 TECHNICAL WRITING AND COMMUNICATIONS SKILLS 0+1

Objective

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

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

Practical

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

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

Suggested Readings

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

Collins' Cobuild English Dictionary. 1995. Harper Collins.

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

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

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

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

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

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

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

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

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

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

Objective

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

Theory

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

Suggested Readings

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

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

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

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

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

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

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

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

Objectives

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

Theory

UNIT I

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

UNIT II

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

UNIT III

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

Suggested Readings

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

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

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