

2. Garewal, S. M., 1985. Pakistan Way of Life and Culture. United Ltd., Lahore, Pakistan
3. Joseph, G., 1984 What the Great Religions Believe, New American Library, New York, USA.

SEMESTER VI

ZOOSES AND FOOD SAFETY

3 (2-1)

Learning outcomes:

At the end of the course, students will be able to:

1. Define and describe the basics of zoonotic diseases and principles of food safety
2. Describe laws and regulations impacting food animal, processing industries and food consumers
3. Describe approaches to microbiological and physical foodborne hazard identification, testing and sampling; and foodborne hazard prevention and control.
4. Describe the route(s) of transmission of major zoonotic diseases, individual and population prevention and control methods for major zoonotic diseases.

Theory:

Introduction to zoonoses and its classification, Impact of zoonotic diseases on human health and economy, Global prevalence of zoonotic diseases, Role of veterinarians in preventing zoonotic diseases, Zoonoses: Viral, Bacterial, Parasitic and Fungal, Companion animals and zoonoses, Handling of zoonotic diseases (e.g. wool sorter's diseases), Regulations regarding zoonotic diseases. Food safety as global issue, Foodborne disease surveillance and outbreak investigation, Food safety monitoring, Drug Resistance and food safety, Surveillance and reporting of food borne illness, Hygienic handling and processing of milk and meat products. Water, Milk- and Meat-borne diseases, Microbiological standards of water, milk, meat, eggs and their by-products, Intoxications associated with food products of animal origin, Residues in food products of animal origin, WTO standards, Importance and need of Communication with media, Role of national and international agencies in controlling emerging and re-emerging diseases, HACCP certification, ISO 22000 and Global Gap program for food safety.

Practical:

Collection, transportation and bacteriological examination of water, milk, eggs and meat samples, Qualitative standards for food safety certification of milk and meat, Quantitative standards, most probable number (MPN) and plate count (APC), Testing of residues (Antibiotics, heavy metals etc), Isolation and identification of pathogens from milk products and molecular diagnostic methods for food pathogens, Schematic sketch for isolation and characterization of bacteria, Screening and diagnosis of brucellosis, Screening

and diagnosis of Tuberculosis, Screening and diagnosis of mastitis, Identification of adulteration in milk samples, Visits to Milk processing plant, Visits to Abattoir, Data collection and analysis of food borne illness.

Textbook:

1. Hartmurt, K., 2009. Zoonoses, 3rd Edition, ASM press, USA.

Recommended Books:

1. Morris, J. G. and M.E. Potter, 2013. Foodborne Infections and Intoxications. 4th ed. Academic Press. USA
2. Rahman, H., L. R. Chatlod and Z.B. Dubal, 2011. Veterinary public health, New trends. Biotech Books, India
3. Pedro, N. A. and S. Boris, 2003. Zoonoses and communicable diseases common to man and animals. 3rd Edition. Pan American Health Organization. USA.

PRINCIPLES OF DAIRY PRODUCTION

3 (2-1)

Learning outcomes:

At the end of the course, students will be able to:

1. Describe current status, challenges and potential of dairy production in Pakistan.
2. Describe modern management systems for enhancement of clean milk production.
3. Run a successful dairy enterprise through modern management techniques and practices.

Theory:

Present status of dairy production in Pakistan; Breeds of local, exotic and crossbred dairy animals; Production systems; Principles of profitable dairy farming; Planning for establishing a dairy farm; management of calves, young stock, dry, pregnant, transition and lactating animals; bull management; housing, welfare and behaviour of dairy animals; reproductive management of dairy animals; farm mechanization; feeding management of dairy animals; heat stress management; biosecurity, hygiene and farm waste management; common ailments, prophylaxis and keeping dairy animals healthy; hygienic milk production and parlour management; mastitis control; marketing of animals, milk and milk products, record keeping, data analysis, report preparation and economic appraisal of a dairy farm.

Practical:

Identification/demonstration of characteristics of local, exotic and crossbred animals; judging and scoring of dairy animals; farm management practices for calves, young stock, dry and lactating animals; observation of animal behaviour and cow signals; heat detection practices, pregnancy diagnosis; milking practice and milk analysis; preparation of housing plans for small, medium and large dairy farms; observation and assessment of housing environment; feed preparation practices; cleaning, sanitation and biosecurity measures in farm

premises; preparation of feasibility reports; fodder production and preservation practices; record keeping and farm management software.

Textbook:

1. Thomas, C.K., N.S.R. Sastry and G. Ravikiran, 2012. Dairy Bovine Production. Kalyani Publishers, New Delhi

Recommended Books:

1. Donald, B., L. Frank, N. Dickinson and H.A. Tucker, 1985. Dairy cattle: Principles, Practices, Problems, Profits. 3rd Ed. Lea & Febiger, Philadelphia.
2. Khan, B.B (Ed.), 2008. Health and Husbandry of Dairy Animals. Pak. T.M. Printers, Faisalabad, Pakistan.
3. Riaz, M., S.H. Raza, M. Lateef and M. Yaqoob, 2006. Principles and Practices in Livestock Management (1st Ed.), Pak TM Printers, Faisalabad.
4. Ensminger, M.E., 1990. Dairy Cattle Science. The Interstate Printers and Publishers Inc., Danville, Illinois, USA.
5. Khan, M.A., 2009. Buffalo; The Animal of Future. *Idara Matbooaat-i- Sulaimani*, Urdu Bazar Lahore.

REPRODUCTIVE BIOTECHNOLOGY

2 (2-0)

Learning outcomes:

At the end of the course, students will be able to:

1. Explain the importance of reproductive biotechnologies and their status in Pakistan
2. Describe steps involved in semen preservation, semen evaluation and cryopreservation.
3. Elaborate different estrus synchronization programs and their field applications
4. Define and explain Embryo transfer (ET), In vitro embryo production (IVEP), In vitro Fertilization (IVF), Pre-implantation genetic diagnosis (PGD) and Intracytoplasmic sperm injection (ICSI)
5. Exemplify and describe advanced reproductive biotechnologies

Theory:

Introduction to biotechnology, Estrous cycle and estrus detection, Basics of estrus synchronization, Application of estrus synchronization, Basics of cryopreservation, Consequences of freezing-thawing, History and status of artificial insemination, Techniques of artificial insemination, Breeding soundness examination, Progeny testing program, Basics of reproductive ultrasonography, Application of reproductive ultrasonography, Introduction to embryo transfer technology, Selection of donors and superovulation, Embryo collection and evaluation, Selection of recipients and embryo transfer, Introduction to *in vitro* technologies, Oocytes collection and grading, *In-vitro* maturation of oocytes, *In-vitro* fertilization and ICSI, *In-vitro* culture of embryos, Assisted reproductive technologies, Applications of assisted reproduction, Pre-implantation genetic diagnosis, Introduction to animal cloning, Application of animal cloning, Gender selection via semen sexing, Gender selection via embryo sexing, Introduction

to stem cells technology, Application of embryonic stem cells, Introduction to therapeutic cloning, Introduction to transgenesis in domestic animals

Textbook:

1. Gordon, I., 1996. Controlled reproduction in cattle and buffaloes. Published by CAB International Willingford, UK

Recommended Books:

1. Meredith, M.J. (Ed), 1995. Animal breeding and infertility. 1st edition Blackwell publishers, Berlin, Germany
2. Senger, P.L., 2003. Pathways to pregnancy and parturition. 2nd Ed. Current Conceptions Inc. Pullman USA

VETERINARY PREVENTIVE MEDICINE-I

3(3-0)

Learning outcomes:

At the end of the course, students will be able to:

1. Characterize the etiology, epidemiology, and clinical manifestations of infectious diseases of ruminants and equines.
2. Describe the main transmission routes for infectious diseases, including animal-human, human-animal, vector-borne, water-borne, and air-borne cycles.
3. Explain mechanism of development/pathogenesis of diseases caused by different infectious agents in ruminants and equines
4. Principles and tools for proper diagnosis and differential diagnosis of infectious diseases of animals.
5. Demonstration of treatment protocols of diseases associated with different pathogenic organisms in animals.
6. Describe interventions used to control and prevent disease, and improve animal health at the individual and herd level.

Theory :

While etiology and pathogenesis are reviewed, emphasis will be given on clinical signs, diagnosis, differential diagnosis, treatment, control and prevention.

Diseases associated with Streptococcus species: (Strangles, Neonatal Streptococcal infection); Diseases associated with Staphylococcus species: (Tick pyemia of lambs); Diseases associated with Corynebacterium species: (Contagious bovine pyelonephritis, Caseous lymphadenitis of sheep and goats, Ulcerative lymphangitis of horses and cattle, Contagious acne of horses); Diseases associated with Listeria species: (Listeriosis); Diseases associated with Bacillus species: (Anthrax); Diseases associated with Clostridium species: (Tetanus, Botulism, Blackleg, Malignant edema, Infectious necrotic hepatitis, Bacillary hemoglobinuria, Enterotoxemia); Diseases associated with Escherichia coli (Acute undifferentiated diarrhea of newborn farm animals, Colibacillosis); Diseases associated with Salmonella species: (Salmonellosis); Diseases associated with Pasteurella species: (Septicemic pasteurellosis (HS), Bovine respiratory disease, Pneumonic pasteurellosis (Shipping fever);

Diseases associated with Brucella species: (Brucellosis); *Diseases associated with Morexilla species:* (Infectious keratitis of cattle); *Diseases associated with Mycobacterium species:* (Tuberculosis, Jonhe's disease); *Diseases associated with Actinomyces spp. Actinobacillus spp., Dermatophilus spp.* (Actinomycosis, Actinobacillosis, Dermatophilosis); *Diseases associated with Fusobacterium and Bacteroides spp.:* (Necrobacillosis, Bovine digital dermatitis, Infectious foot rot); *Diseases associated with Pseudomonas and Burkholderia spp.:* (Fleece rot in sheep, Glanders); *Diseases associated with Leptospira spp.:* (Leptospirosis); *Diseases associated with Mycoplasma spp.:* (Contagious bovine pleuropneumonia, Contagious agalactia in sheep and goats, Contagious caprine pleuropneumonia, Mycoplasmal arthritis in cattle); *Diseases of mammary glands:* (Mastitis, Udder edema, blood in milk, Viral lesions of udder and teat); *Viral diseases with manifestations attributable to involvement of body as whole:* (Equine infectious anemia, Bovine ephemeral fever, African horse sickness, Rift valley fever); *Viral disease characterized by alimentary tract signs:* (Foot and mouth disease, Vesicular stomatitis, Rinderpest, Peste des petits ruminants, Malignant catarrhal fever, Bovine virus diarrhea/mucosal disease, Viral diarrhea in calves, lambs, kids and foals, Winter dysentery in cattle, Bluetongue); *Viral diseases characterized by respiratory signs:* (Viral infections of the upper respiratory tract of horses, Equine herpes virus infection, Equine viral arteritis, Equine influenza, Enzootic pneumonia of calves, Bovine respiratory syncytial virus pneumonia, Infectious bovine rhinotracheitis); *Viral diseases characterized by nervous signs:* (Viral encephalomyelitis of horses, Rabies, Pseudorabies, Sporadic bovine encephalomyelitis, Ovine encephalomyelitis, Caprine arthritis encephalitis); *Viral diseases characterized by skin lesions:* (Contagious ecthyma, Lumpy skin disease, Cowpox/Sheeppox/goatpox/Horsepox); *Diseases associated with prions:* (Scrapie, Bovine spongiform encephalopathy); *Diseases associated with Rickettsiales:* (Anaplasmosis, Tick-borne fever, Equine granulocytic Anaplasmosis, Potomac horse fever, Q Fever, Lyme disease); *Diseases associated with algae and fungi:* (Aspergillosis, candidiasis, Ringworm); *Diseases associated with protozoa:* (Babesiosis, Theileriosis, Coccidiosis, Neosporosis, Cryptosporidiosis, Toxoplasmosis.); *Disease associated with Trypanosomes:* (Nagana /Surra, Dourine); *Nematode diseases of the alimentary tract:* (Parasitic gastroenteritis in ruminants, Strongylosis in horses, Miscellaneous roundworm infestation (Oxyuris equi, Strongyloides, Trichuris)); *Nematode diseases of other organs:* (Lungworm); *Nematode induced skin conditions:* (Summer sores in horses, Filarial dermatitis/Parafilariosis); *Nematodes affecting eye:* (Thalazia); *Diseases associated with trematodes and cestodes:* (Fasciolosis, Stomach fluke disease, Adult and larval tapeworm infestation, GID); *Diseases associated with arthropod parasites:* (Stomach bot, Nasal bots, Warble flies, Sheep ked, Tick infestations, Stable flies, Horse flies, Biting midges); *Mite infestation:* (Demodectic mange, Sarcoptic mange, Psoroptic mange, Chorioptic mange):

Textbook:

1. Radostitis, O.M., C.C. Gay, K.W. Hincheliff and P. D. Constable, 2007. Veterinary Medicine, 10th Ed. Saunders Elsevier, PA, USA.

Recommended Books:

1. Kahn C.M., 2010. The Merck Veterinary Manual. 10th Ed. Merck & Company., INC, Whitehouse Station, N.J., USA.
2. Matin W. B. and I. D. Ait Isen, 2000. Diseases of Sheep, 3rd Ed. Blackwell Science, Oxford, UK.
3. Howard J.L, 1999. Current Veterinary Therapy, Food Animal Practice. W.B. Saunders, Co., USA.
4. Rebhum, W.C., 1998. Diseases of Dairy Cattle, Williams and Willkins, Baltimore, USA.
5. Smith B.P., 1996. Large Animal Internal Medicine. 2nd Ed. The Mosby Co. Philadelphia U.S.A.
6. Hungerford. T.G., 1991. Hungerford's Diseases of Livestock 9th Ed. McGraw Hill Book Company, Sydney, Australia.
7. Morgan R.V., 1997. Handbook of Small Animal Practice. 3rd Ed. W.B. Saunders Company, PA, USA.

MEAT INSPECTION AND NECROPSY PRACTICE

3 (2-1)

Learning outcomes:

At the end of the course, students will be able to:

1. Differentiate between meat of different animals
2. Evaluate meat for wholesomeness
3. Describe the cause of death and pathological lesions.
4. Demonstrate understanding of vetro-legal cases

Theory:

Food animals, slaughter house / abattoir management, Halal meat industry, objectives of meat inspection, antemortem and postmortem examination of animals, non-specific and specific lesions in different organs of body, rigor mortis, conditions rendering meat unwholesome for human consumption, judgment of carcass, disposal of condemned meat, laws regulating meat quality in Pakistan, differentiation of meat of different animals, recognition of contagious and zoonotic diseases associated with abattoirs, differentiation between lesion and postmortem changes, postmortem of large, small, poultry and wild animals, diagnostic features of accidental and infectious causes of death, single and group animal death features, importance of forensic veterinary pathology, laws governing forensic examination of animals.

Practical:

Meat inspection procedure, wholesomeness of carcass, techniques for differentiation of meat of different species of animals, laboratory tests for evaluation of wholesome meat, examination of live and dead animals in forensic cases, necropsy techniques, safety measures to be observed while performing necropsy, disposal of carcasses suspected to be suffering from contagious and zoonotic diseases, visits to slaughter house / abattoir for examining, processing (meat by-products) and further processing (value addition) technologies.

Textbooks:

1. Gracey, J.F., 2014. Meat Hygiene. 11th Edition. The English Language Book Society, Bailliere Tindal, London U.K.
2. Cooper, J.E., M.E. Cooper, 2007. Introduction to Veterinary and Comparative Forensic Medicine. Wiley-Blackwell, USA.

Recommended Books:

1. Herenda, D.C. and D.A. Franco. 1991. Food Animal Pathology and Meat Hygiene. Mosby Year Book. London.
2. FAO, 2000. Manual on meat inspection for developing countries, 2nd Ed., Vol. 119, Food and Agriculture Organization of United Nations, Rome, Italy.
3. Grist, A., 2004. Poultry Inspection: Anatomy, Physiology and Disease condition, 2nd Ed., Nottingham University Press.

DIAGNOSTIC IMAGING**2 (1-1)****Learning outcomes:**

At the end of the course, the student will be able to:

1. Describe basics of plain and contrast radiographic techniques.
2. Diagnose different medical and surgical ailments through radiographic presentations as seen on radiographs.
3. Demonstrate practical skills in general abdominal sonography.
4. Demonstrate practical skills for performing a survey radiographic exposure and film processing.

Theory:

Scope of diagnostic imaging in veterinary practice; Radiographic terminology and basic principles to study radiographs; Nature and production of X-rays; Radiographic image formation; Radiographic hazards and protection; Radiography of the skeletal system; Plain and Contrast radiography of Urinary System; Plain and Contrast radiography of Gastro-intestinal System; Plain and Contrast radiography of Respiratory System; Principles of Diagnostic Ultrasound including indications and techniques; Ultrasound Artifacts; Sonography of the General Abdomen: Liver, Pancreas, Adrenals and Spleen; Sonographic features of Gastrointestinal Tract; Sonographic features of Urinary Tract & Reproductive Tract; Sonography of Musculoskeletal System; Sonographic features of Eye and Orbit; Imaging of Heart and Doppler Ultrasound; Magnetic Resonance Imaging (MRI); CT Scan.

Practical:

X-ray machine and its working; Dark room requirements and maintenance; Exposure factors and processing of films; Contrast Radiography techniques; Examination and evaluation of radiographs; Techniques for radiography of appendicular and axial skeleton; Imaging of the general abdomen; Imaging of liver and spleen; Imaging of gastrointestinal tract and pancreas; Imaging of urinary tract; Imaging of reproductive tract; Imaging of musculoskeletal system; Imaging of head; Imaging of cardiovascular system; Use of ultrasonography equipment; Imaging of clinical cases presented to the clinics of the Department.

Textbook:

1. Thrall, D.E., 2002. Textbook of Veterinary Diagnostic Radiology. 4th ed. W. B. Saunders Co., Philadelphia, USA.

Recommended Books:

1. Penninck, D., and M-A d' Anju, 2008. Atlas of Small Animal Ultrasonography. Blackwell Publishing Co., Oxford. UK.
2. Mannion, P., 2006. Diagnostic Ultrasound in Small Animal Practice. Blackwell Science Ltd., Oxford, UK.
3. Kealy, J. K., and H. McAllister, 2004. Diagnostic Radiology and Ultrasonography of the Dog and Cat. 4th ed. W. B. Saunders Co., Philadelphia, USA
4. Farrow, C. S., 2003. Veterinary Diagnostic Imaging: the Dog and Cat. Mosby Inc., W. B. Saunders Co. Ltd., USA.
5. Cartee, R. E., B. A. Selcer, J. A. Hudson, S. T. Finn-Bodner, M. B. Mahaffey, P. L. Johnson and K. W. Marich, 1995. Practical Veterinary Ultrasound. Williams and Wilkins, Philadelphia, USA.
6. Singh, A. P., and J. Singh. 1995. Veterinary Radiology. CBS Publishers & Distributors, New Delhi, India.

MEDICINE CLINIC-I**1 (0-1)****Learning outcomes:**

At the end of the course, students will be able to:

1. Perform disease diagnosis and treatment of clinical cases of alimentary, respiratory, cardiovascular, hemopoietic and lymphatic systems in small and large animals.
2. Exhibit social behaviors with colleagues, clients, and patients consistent with those expected of a member of the veterinary community. Demonstrate knowledge and understanding of the societal responsibilities of veterinarians locally, nationally and globally
3. Demonstrate basic knowledge and understanding of first aid and emergency care of animal diseases.
4. Demonstrate knowledge and understanding of the rationale use of therapeutics and their availability in the market.
5. Demonstrate basic knowledge and understanding of disposal of biomedical wastes in veterinary hospitals and associated hazards.
6. Development of core competencies in clinical case recording.

Clinic:

Exercises in diagnosis and treatment of clinical cases of diseases of alimentary system, respiratory system, cardiovascular system, hemopoietic and lymphatic system in livestock and pets, Communication skills (Veterinarian-client interaction), First aid procedures and emergency medicine, Practice of feeding of sick animals, Practical antimicrobial therapy/rationale therapeutics, Generic and trade names of drugs along with their doses, Disposal of biomedical wastes in veterinary hospitals, Hazards of biomedical wastes and their impact on environment, Basic concept of civic engagement, Deworming procedure and

doses for different species of animals/pets/birds, Professional development and social responsibilities of veterinarian, Preparation of case records, case follow up etc., Recording of minimum 10 cases at pet center under the supervision of teacher and making a presentation after consulting veterinary information resources like journals, books and internet etc., Study tours to livestock farms and Veterinary Hospitals.

Recommended Books:

1. Radostitis, O.M., C.C. Gay, K.W. Hincheliff and P. D. Constable., 2007. Veterinary Medicine, 10th Ed. Saunders Elsevier, PA, USA.
2. Kelly, W. R., 1984. Veterinary Clinical Diagnosis. 3rd Ed. Bailliere Tindall & Corsell, London, U. K.
3. Kahn C.M., 2010. The Merck Veterinary Manual. 10th Ed. Merck & Company., INC, Whitehouse Station, N.J., USA.
4. Pinsent, P.J.N. and C.J. Fulle, 1997. Outline of Clinical Diagnosis in Horse. Blackwell Science, Oxford, UK.
5. Howard J.L, 1999. Current Veterinary Therapy, Food Animal Practice. W.B. Saunders, Co., U.S.A.
6. Hungerford. T.G., 1991, Hungerford's Diseases of Livestock 9th Ed. McGraw Hill Book Company, Sydney, Australia.
7. Smith B.P., 1990. Large Animal Internal Medicine. The C.V. Mosby Company, Baltimore.

SURGERY CLINIC-I

1(0-1)

Learning outcomes:

At the end of the course, students will be able to:

1. Perform general examination of the clinical cases of different animals
2. Perform medication of traumatic animals
3. Demonstrate clinical procedures to treat animals.

Clinic:

General Examination, Asepsis & Antiseptics, Wound management, Antiseptics used in clinics, Bandages and bandaging techniques, Routes of Drug administration, Animal Chipping.

Students will be required to record a minimum of 10 clinical cases (history taking, clinical findings, laboratory investigation, diagnosis, differential diagnosis treatment and discussion) in each clinic case under the supervision of a teacher.

Recommended Books:

1. Venugopalan, A. 2000. Essentials of Veterinary Surgery. 8th ed. Oxford and IBH Publishers and Distributors, New Delhi, India.
2. Kumar, A. 1997. Veterinary Surgical Techniques. Vikas Publishing House, New Delhi, India.
3. Harari, J. 1993. Surgical Complications and Wound Healing in the Small Animal Practice, W. B. Saunders Co., Philadelphia, USA.
4. Kelly, W. R. 1984. Veterinary Clinical Diagnosis. 3rd Ed. Bailliere Tindall, London, UK.

THERIOGENOLOGY CLINIC-I

1 (0-1)

Learning outcomes:

At the end of the course, students will be able to:

1. Explain the importance of history taking for a clinical case.
2. Describe the protocol for approaching clinical cases at reproduction clinic

Clinic:

Steps to identify a clinical case of reproduction, Approach to clinical case and pre-requisites for handling, Palpation & identification of female reproductive system on table, Technique of rectal palpation in domestic animals, Identification of parts of reproductive tract in live animals, Identification of ovarian structures in live animals, Determination of stage of estrus cycle in live animals, Development of models for estrus detection, Selection of a bull for breeding, Functioning of Semen Production Units.

Recommended Books:

1. Zemjenis, R., 1970. Diagnostic & Therapeutic Techniques in Animal Reproduction. Williams & Wilkins Company, Baltimore
2. Morrow, D.A., 1986. Current Therapy in Theriogenology, II. W.B. Saunders Company, Philadelphia
3. Ahmad, M. and M.A. Saji, 1997. Manual for Breeding Soundness of Dairy Bulls for use in A.I. Livestock and Dairy development Department, 16-Cooper Road, Lahore

SEMESTER VII

BEEF AND MUTTON PRODUCTION

2 (1-1)

Learning outcomes:

At the end of the course, students will be able to:

1. Describe current status of meat production in Pakistan.
2. Identify indigenous and exotic breeds,
3. Describe appropriate and cost effective management, feeding and processing system of meat production.
4. Establish a successful meat production unit through application of modern management techniques and practices.

Theory:

Status of meat production in Pakistan, issues and potential of meat industry in Pakistan, meat type breeds of farm animals, meat production systems, factors affecting carcass and meat quality; management of meat animals, feeding management for optimum growth, grazing systems, management and supplementary feeding, growth rate and fattening potential of male calves, feed additives, hormones and probiotics for growth, management during inclement weather. breeding and reproduction of meat animals, modern abattoirs,