SEMESTER III

PRINCIPLES OF ANIMAL NUTRITION 3 (2-1)

Learning outcomes:

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

1. Define and explain terminology used in the animal nutrition
2. Describe major nutrient classes, feed classification, processing, and preservation procedures
3. Elaborate relationship between dietary classification of animals and digestive processes in GIT
4. Perform proximate analysis and describe its applications in animal nutrition.

Theory:

A brief history and scope of animal nutrition. Comparative digestive anatomy and physiology of ruminants and non-ruminants. Pre-gastric and Post-gastric digestion and absorption of major nutrients. Rumen ecology. Regulation of feed intake in non-ruminants and ruminants. Classification and functions of nutrients. Importance of water in the animal bodies its sources, requirements and losses. Carbohydrates nutrition: Structure classification, digestion and metabolism. Volatile fatty acids (VFA): production, absorption and metabolism in ruminants. Lipids: classification, structure, digestion and metabolism. Protein and amino acid: classification, structure digestion and metabolism. Introduction to mineral and vitamins in animal nutrition.

Practical:

Identification of feed stuffs and their nutritional composition. Sampling techniques for feed ingredients and forages. Processing of samples for chemical analyses. Proximate analysis: dry matter (DM), ash, crude protein (CP), ether extract (EE) and crude fiber (CF) determination. Sample preparation for mineral analysis.

Textbook:

1. Pond, W.G., D.C. Church and K.R. Pond, 2006. Basic Animal Nutrition and Feeding. 5th Ed. John Willey and Sons, New York, USA.

Recommended Books:

1. McDonald, P., R.A. Edwards, J.F.D. Greenhalgh, C.A. Morgan, L, Sinclair and R. Wilkinson, 2011. Animal Nutrition. 7th ed. Benjamin Cummings, USA.
2. Perry, T.W., A.E. Cullision and R.S. Lowery, 2008. Feeds and Feeding.6th Edition. Prentice Hall, New Jersey, USA.
3. Banerjee, G.C., 2005. Feeds and Principles of Animal Nutrition. Oxford, IBH Publishing Co., Pvt. Ltd. New Delhi, India.
4. Sarwar, M. and Zia-ul-Hasan, 2000. Nutrient Metabolism in Ruminants. University of Agriculture Press, Faisalabad.
5. A.O.A.C., 2000. Official Methods of Analysis of the Association of Official Analytical Chemists. Vol 2, 17th Ed. Arlington, VA. USA.

GENERAL AND SYSTEMIC PHARMACOLOGY 4 (3-1)

Learning outcomes:

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

1. Describe transport mechanisms, classification, formulation and routes of administration of drugs
2. Describe pharmacokinetics and pharmacodynamics of drugs of veterinary importance.
3. Describe drugs acting on body systems and mucous membranes.
4. Demonstrate preparation of pharmaceutical preparations and effects of various drugs *in vivo* and *in vitro*.

Theory:

General Pharmacology: Introduction to Pharmacology, historical perspectives and definitions, drug sources , classification of drugs, nomenclature of drugs and drugs information sources, drug development and drug regulations, pharmacokinetic principles and application, transport of drugs across cell membranes and absorption of drugs, distribution of drugs, metabolism of drugs, elimination of drugs, pharmaco dynamic concepts of drugs and receptors, structure activity relationship and receptor theories, dose-response relationship, graded dose response, quantal dose response, therapeutic index, adverse drug reactions and drug resistance/tolerance, factors modifying the drug effects and drug interactions. **Systemic Pharmacology:** Pharmacology of Autonomic Nervous System: Cholinergic and anticholinergic, adrenergic and antiadrenergic, neuromuscular blocking agents and ganglionic blocking agents, pharmacology of central nervous system: Anaesthetics and pre-anaesthetic medication, analgasics. narcotic analgasics, anti-inflamatory drugs, local anaesthetics, sedatives, hypnotics and tranquilizers, central nervous system stimulants, analgesics and anti-inflammatory drugs, autacoids, drugs affecting digestive system (simple stomach and ruminants), drugs affecting respiratory system, drugs affecting cardiovascular system, drugs affecting uro-genital system, electrolytes, endocrine pharmacology, drugs for skin and mucous membranes, comparative pharmacology, drugs acting on immune system, nutraceuticals.

Practical:

Weights and measures, prescription writing and pharmaceutical calculations, formulations; external and internal dosage forms, techniques of drug administration in animals and identification of various drugs, preparation of ointments, preparation of solutions, preparation of tinctures, collection of blood in common laboratory animals, anesthesia and euthanasia, demonstration of techniques of volatile and intravenous anesthetics, general anesthetics and preanaesthetic medication, effect of drugs on isolated heart of rabbits or guinea pigs, effect of drugs on isolated intestine of rabbits or guinea pigs, effect of drugs on intestinal motility on isolated tissue bath, effect of autonomic drugs on eyes of rabbits, preparation of stomach powder for ruminants, preparation of saline electuary for ruminants, demonstration of diuretic and antidiuretic drugs action

in animals, demonstration of analgesic activity and local anaesthetic effect of drugs in laboratory animals, visit to pharmaceutical industry.

Textbook:

1. Riviere J.E. and M.G. Papich, 2009. Veterinary Pharmacology and Therapeutics, 9th Edition. Wiley-Blackwell.

Recommended Books:

1. Akhtar, M.S., 2004. Introduction to Veterinary Pharmacology & Therapeutics. 3rd Ed. Agri. Livestock Bureau Pakistan, Faisalabad.
2. Sandhu, H.S., 2013. Essentials of Veterinary Pharmacology & Therapeutics. 2nd Ed. Kalyani Publishers, Ludhiana, India.
3. Hardman, J.G. and L.E. Limbird, 2005. Goodman and Gillman Pharmacology Basis of therapeutics, 11th ed., McGraw-Hill, New York, USA.
4. Clark, M.A., 2001. Lippincott's Illustrated Reviews Pharmacology. 5th Edition. Williams & Wilkins, Philadelphia.
5. Katzung, B.G., 2012. Basic and Clinical Pharmacology. 12th Ed., McGraw-Hill, New York, USA.
6. The Merck Veterinary Manual. 2010. 10th edition. Merck & Co., INC. White House Station, N. J., USA
7. Sandhu, H.S., 1999. Laboratory Manual on Veterinary Pharmacology and Toxicology, Kalyani Publishers, Ludhiana, India.

GENERAL VETERINARY PATHOLOGY 3 (2-1)

Learning outcomes:

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

1. Define and explain terminology used in Pathology
2. Differentiate between normal, artifacts and pathological structures
3. Define and describe Pathogenesis and Pathophysiological processes.

Theory:

Introduction to Pathology, Terminology used in pathology, adaptations, atrophy, hypertrophy, hyperplasia, dysplasia, aplasia, reversible and irreversible cell injury, cell death, necrosis, disturbances of mineral metabolism and pigmentation, disturbances of circulation, Inflammation, repair and healing of wounds and fractures, neoplasia; causes, pathogenesis, classification, auto-immunity, molecular pathology.

Practical:

Tissue sampling, preservation, processing and staining techniques: Sudan, Periodic Acid Schiff, MT etc. Demonstration of general, gross and microscopic picture of reversible and irreversible cell injury, atrophy, hypertrophy, hyperplasia, dysplasia. Calcification, melanosis, Disturbances of circulation: congestion, hyperemia, edema, Inflammation: acute and chronic, granulation tissue, Neoplasia: epithelial, connective tissue, bone, skin tumors.

Textbook:

1. Zachary, J.F., and McGavin, 2013. Pathological basis of Veterinary Disease, 5th Ed., Elsevier, USA.

Recommended Books:

1. Macfarlane P.S., R. Reid and R. Callander, 2011. Pathology Illustrated, 7th Ed., Churchill Livingstone, Edinburgh, UK.
2. Slauson, D.O. and B.J. Cooper, 2002. Mechanisms of Disease: A textbook of Comparative General Pathology. 3rd Ed. Mosby Inc, A Harcourt Sciences Company, St Lousi MO 63146.

GENERAL VETERINARY PARASITOLOGY AND PROTOZOOLOGY 3 (2-1)

Learning outcomes:

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

1. Describe the nomenclature used in parasitology and classify parasites
2. Describe life cycle, pathogenesis and control of protozoan diseases
3. Collect and process biological samples and parasite specimens for identification / diagnosis.

Theory:

Introduction to parasitology, effects of parasites on their hosts and their economic importance; Basic terminology, Host parasite relationship, Types of parasitism, Organ specificity, Ecology of parasites, types of hosts, modes of infection of parasites, nomenclature and classification of parasites, parasitic zoonosis, immunity against parasites; General concepts on Parasite control strategies. Introduction to protozoology; history and differences from other unicellular organisms; Anatomy and physiology of protozoa; classification, morphology, life cycle, pathogenesis, diagnosis, treatment and control of the important species of the following genera of protozoa: Trypanosoma/Leishmania, Trichomonas and Histomonas, Entamoeba, Giardia, Balantidium, Eimeria, Isospora, Toxoplasma, Sarcocystis, Plasmodium, Haemoproteus, Leucocytozoan, Hepatozoan, Babesia, Theileria, Anaplasma, Cryptosporidium, Ehrlichia, Eperythrozoan and Neospora; Immunity against protozoan parasites.

Practical:

Introduction to laboratory ethics; qualitative and quantitative faecal examinations, Interpretation of faecal oocyst / egg count; methods of blood examination; quality control for blood examination and pseudoparasites; examination of urine, genital discharges, sputum and cerebrospinal fluid for protozoa; mounting of protozoa; culturing of protozoa; morphological examination of intestinal protozoa, Identification of different protozoa (included in theory course) from field isolates and specimen slides.

Textbook:

1. Schmidt G.D. and L.S. Roberts, 2013. Foundations of Parasitology. 9th Edition, W.C.B. Company, U.K.

Recommended Books:

1. Akhtar, M., M.A. Hafeez and C.S. Hayat, 2003. General Parasitology and Protozoology. The Elite Scientific Publications, Faisalabad-Pakistan.

Bowman D. D. (2013): Georgis' Parasitology for Veterinarians. 10th Ed. Saunders Elsevier.
2. Urquhart G.M., J. Armour, J.L. Duncan, A.M. Dunn, F.W. Jennings, 2000. Veterinary Parasitology. Longman Scientific and Technical, U.K.
3. Foreyt, W.J., 2001. Veterinary Parasitology, Reference Manual Iowa State Press, Blackwell Publishing Company.
4. Zajac A.M. and G.A. Conboy, 2006. Veterinary Clinical Parasitology 7th Edition. Blackwell Publishing AAVP.
5. Iqbal, Z., M.S. Sajid, A. Jabbar, R.Z. Abbas and M.N. Khan, 2006. Techniques in Parasitology. Higher Education Commission, Islamabad-Pakistan.
6. Hayat, C.S. and M. Akhtar. 1999. Parasitic Diagnosis. University Grants Commission, Islamabad, Pakistan

VETERINARY IMMUNOLOGY 2 (1-1)

Learning outcomes:

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

1. Define and describe concepts of immunity
2. Describe immunogens, their properties and nature of vaccines
3. Elaborate immunogenesis or fate of vaccine material in the host
4. Describe and differentiate between immunoglobulins
5. Describe control of microbial infections through immunity
6. Describe vaccine reactions
7. Apply immunotherapy in field viral diseases.

Theory:

Definition, immunity and types of immunity, Innate (non specific) immunity, active and passive immunity, natural and artificial immunity, cell mediated and humoral immunity, autoimmunity, hypersensitivity etc. Non-specific resistance and natural barriers of defense such as sweat sebaceous, skin, mucus membranes, saliva, secretions, phagocytic cells, complement, inflammation, fever, Phagocytosis, (mechanism of phagocytosis and microbicidal activity, evasion of phagocytosis and bactericidal activity, survival of bacteria in macrophages, Immune response: Primary response, booster or secondary response, differences between the both, Immune system: primary lymphoid organs such as bursa of Fabricius and thymus, secondary lymphoid organs such as spleen, lymph nodes, MALT or GALT. Cells of the immune system (birds and animals): B and T lymphocytes, Immunocytes, types of lymphocytes, Th lymphocytes or Th cells, B lymphocytes/ B cells, natural killer cells. Vaccines, types of vaccines, antigens/immunogens: Essential features of antigens/ immunogen, antigenic epitopes, adjuvant, HACCP, SOP, protocols, BMR, labels, vaccine, types of vaccines, cold chain, routes of vaccination, Immunogenesis: Antigen processing cells for exogenous and endogenous antigens, Immunogenesis: Fate of foreign antigen/immunogen/vaccine material within the body, presentation of T cell independent antigens and processing of T cell dependent antigens, Immunoglobulins: structure, chemical nature,

classification, and antibody specificity, functions, Humoral immunity: Agglutination, precipitation, CFT), Humoral immunity: ELISA, FAT, VN), Cell mediated immunity (potency/efficacy, MTT assay, thymidine up-take assay, cytokine assay. Immunotherapy and its applications in viral diseases, Hypersensitivity and its types, *Hypersensitivity type I, Hypersensitivity type II,* Hypersensitivity type III and Hypersensitivity type IV

Practical:

Microscopic examination of mammalian blood cells, Demonstration of organs of immune system, Preparation of HA antigen/bacterial antigen/RBC, Raising antiserum against sheep RBC, calculation of sub-agglutinating titer, sensitization of RBCs, Collection of guinea pig or human serum, its complement titration, mixing of blood from different blood groups, Complement fixation test, HA and Hi test demonstration, Calculation of GMT of CFT, HI, bacterial agglutination and precipitation tests and demonstration of results, Bacterial agglutination test, AGPT: Gel preparation and punching of wells, charging of samples, AGPT: Demonstration of results, ELISA test against any virus disease, Skin sensitivity tests (tuberculin test or mallein test), Virus neutralization test (NDV) in chicken embryos, Fluorescent microscopy (Rabies detection), Immunotherapy: treatment of NDV, study tour to Research Institutes / Vaccine Production Unit.

Textbook:

1. Tizzard, I. R., 2013. Veterinary Immunology -An Introduction, 6th Ed. W. B. Saunders Co., London.

Recommended Books:

1. Abbas, A. K., H. L. Andrew and S. P. Jordan, 2008. Cellular and Molecular Immunology. W. B. Saunders Co., London.
2. Kuby, J., 1996. Immunology. 2nd Edi. W. H. Freeman and Co., New York.
3. Quinn, P. J., 2012. Veterinary Microbiology and Microbial Disease. 1st Edi. Blackwell Science Ltd., USA.
4. Anonymous, 1999. A laboratory manual for the isolation and identification of avian pathogens. 6th Ed. American Association of Avian pathologists, Iowa State University Press, Ames, Iowa.
5. Hay F. C. and O. M.R. Westwood, 2002. Practical Immunology, Blackwell Science, 4th Edition.

ANTHROPOLOGY 1 (1-0)

Learning outcomes:

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

1- Define and identify basic concepts of anthropology
2- Explain Pakistani society and culture
3- Differentiate between various social setups and subcultures
4- Describe the contribution of women and children to rural development.

Theory:

Anthropology and its basic concepts; society; culture and subcultures; norms, values; socio-cultural processes; social groups; human behaviour; socialisation and personality; social institutions, marriage and family systems; village life and status of farmers in society; social stratification; social change and factors affecting change process; role of women and children in rural development; global social problems.

Textbook:

1. Ember, C.R. and M. Ember, 2011. Cultural Anthropology. 13th edition. Pearson, Printice Hall, USA.

Recommended Books:

1- Iqbal, C.M., 2002. Sociology. Aziz Publications. Lahore
2- Singh, M., 2007. Rural Sociology. Anmol Publications. New Delhi. India
3- Giddens A., 2006. Sociology. 5th Edition. Polity Press, Cambridge, UK

2 (1-1)

MOLECULAR BIOLOGY

Learning outcomes:

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

1. Describe the structure, function and types of RNA and DNA
2. Describe the process of manipulation in genome, replication and transcription mechanisms
3. Describe the genomic libraries
4. Describe / Perform protein analysis, DNA and RNA extraction, run the PCR, electrophoresis and detection of bands on gel

Theory:

Introduction to Molecular Biology, RNA, DNA, Genes and chromosomes, Structure of DNA, Replication of DNA, Expression of genetic information, Endoribonucleases, Ligases, Principle of polymerase chain reaction, Principles of primer designing for PCR, DNA sequencing: principle and methods, Introducing mutations in DNA, Site directed mutagenesis in a given gene, Vectors and their uses in molecular biology, Modifications of phage vectors and their uses, DNA modification enzymes, adaptors and their uses, Regulation of gene expression, Restriction fragment length polymorphism, Genetically modified organisms/animals.

Practical:

Good lab practices, Genomic DNA extraction from eukaryotic and prokaryotic cells, Plasmid DNA extraction, RNA extraction, Protein estimation, SDS-PAGE, Staining of gel and its documentation, Estimation of nucleic acids, Western Blotting, Southern Blotting, Northern Blotting and their result interpretation, Reverse Transcriptase of RNA, PCR, Use of computers for DNA and protein sequence data from world wide web (Bioinformatics).

Text book:

1. Gupta, P.K., 2014. Elements of Biotechnology, 2nd edition. Rastogi Publications, India.

Recommended Book:

1. Green, M.R., J. Samrook, 2012. Molecular Cloning: A Laboratory Manual, 4th Edition (3 volume set). Cold Spring Harbor Laboratory Press.

LAB AND ZOO ANIMAL MANAGEMENT 1 (0-1)

Learning outcomes:

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

1. Construct/ establish laboratory and zoo animal housing facilities
2. Deal with the day to day management issues
3. Note the behavioral aspects and assessing the health status and stress issues
4. Determine the nutritional requirements of various laboratory and zoo animals
5. Handle various lab and zoo animals
6. Demonstrate techniques of capturing animals in the field

Practical:

Lab Animals: Introduction to lab animals, Lab animals' facilities designs, management issues in lab animals, Record keeping procedures, Daily feeding, husbandry and management practices, Handling of various lab animals, Common infections in laboratory animals, Conduction of minor procedures like anesthesia of laboratory animals, management of pain, distress and lasting harm, Observations on behavioral aspects in lab animals. **Zoo Animals:** Introduction to lab animals, Importance of zoos in conservation, Calculations on economics of zoo animals, Feeding requirements, husbandry practices and management issues, Record keeping procedures and tagging, Enclosure designs, dimensions and housing requirements of various mammalian and avian species in zoos, visit of museums to observe stuffed animals, Netting/trapping techniques for various animals in the field.

Text Books:

1. Cheeran J.V., 2008. Textbook of Wild And Zoo Animals: Care And Management. 2nd Revised Edition Textbook Student Edition.
2. Pool, T.B., 1989. The UFAW Handbook on the Care and Management of Laboratory Animals. Longman Scientific and Technical Publishers, England. UK.

Recommended Books:

1. Clark. J. D., K. A. Baldwin, M.J. Bayne, G.F. Brown, J.C. Gebhart, J.K. Gonder, M.E. Gwathmey, D.F. Keeling, J.W. Kohn, O.A. Robb and W.J. Smith White, 1996. Guide for the Care and Management of Laboratory Animals. National Research Council, National Academic Press, Washington, D. C. 6th edition.

2. Mathialagan P., 2007. Textbook of Animal Husbandry and Livestock Extension. 3rd Revised and Enlarged Edition Textbook Library Edition. International Book Distributing Company.
3. Hosey, G.,M. Vicky and S. Pankhurst, 2013. Zoo Animals: Behaviour, Management, and Welfare Oxford University Press, 696 pp.
4. Rees, P.A., 2011. An Introduction to Zoo Biology and Management, John Wiley & Sons, 432 pp.
5. Kleiman, D.G., K.V. Thompson and C.K. Baer, 2010. Wild Mammals in Captivity: Principles and Techniques for Zoo Management, 2nd Edition, University of Chicago Press.
6. Miller, E. and E. Murray, 2011. Fowler's Zoo and Wild Animal Medicine Current Therapy, Elsevier Health Sciences.

SEMESTER IV

LIVESTOCK FEED RESOURCES AND FORAGE CONSERVATION 3 (2-1)

Learning outcomes:

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

1. Enlist feed resources and describe their classification.
2. Explain nutrient profile of feed resources and their role in ruminant ration.
3. Describe different techniques of forage preservation
4. Describe efficient way of roughage utilization
5. Elaborate ruminant digestive physiology and metabolism
6. Calculate nutrient balance and formulate rations for ruminants
7. Describe emerging trends in ruminant nutrition and their practical implications

Theory:

Classification and nutritional composition of feed stuffs for ruminants: fodders, forages, dry roughages and concentrate feed stuffs. Anti-nutritional factors in feed stuffs for ruminants. Improvement of nutritional quality of low quality roughages. Forage production systems in Pakistan and their implications. Lean periods in forage production and methods to overcome shortage in lean period. Strategies and techniques to improve the nutritional quality of low quality roughages. Conservation of forages for commercial livestock production operations; silage and hay making. Ruminant nutrition: calf nutrition, heifer nutrition, dairy nutrition, meat animal nutrition. Feeding systems for commercial dairy, TMR feeding. Feed Additives and performance modifiers for ruminants. Nutritional and metabolic disorders.

Practical:

Identification of fodders and forages used in conventional and commercial ruminant production systems. Hay and silage preparation. Physical and chemical evaluation of hay and silage samples; laboratory analysis of fodders