UNIVERSITY OF SARGODHA
OFFICE OF THE REGISTRAR
(ACAD BRANCH)

NOTIFICATION

On the recommendations of Academic Council made in its 21st (2/2024) meeting held on 07.06.2024, the Syndicate in its 67th (3/2024) meeting held on 12.07.2024 approved the revised curricula of the following programs for implementation w.e.f. Fall 2024:

I.	M.Sc (Hons.) in Animal Nutrition	Annex-'A'
II.	M.Phil in Animal Sciences	Annex-'B'
III.	Ph.D in Animal Sciences	Annex-'C'

(WAQAR AHMAD)
Additional Registrar (General)

No. SU/Acad/25/ 119

Dated: 31.01.2025

Distribution:

- Chairman, Department of Animal Sciences
- Controller of Examinations
- Director Academics

C.C:

- Dean, Faculty of Agriculture
- Principal, College of Agriculture
- Director QEC
- Secretary to the Vice-Chancellor
- PA to Registrar
- Notification File

Scheme of Studies for the Degree of

Master of Philosophy in Animal Sciences

Implementation w.e.f. Fall Semester, 2025

OK

DEPARTMENT OF ANIMAL SCIENCES

COLLEGE OF AGRICULTURE

UNIVERSITY OF SARGODHA

2025

Chairman
Department of Animal Sciences
College of Agriculture
University of Sargodha

Vetted
24/01/2025

1. **Nomenclature of the Program:**

Master of Philosophy in Animal Sciences

2. **Department brief:**

Department of Animals Sciences, College of Agriculture, Faculty of Agriculture, University of Sargodha, Sargodha, was established in 2010. Department is offering one undergraduate and one postgraduate program as B.Sc. Honors Animals Sciences and M.Sc. Honors Animal Nutrition respectively. The Department aims at the delivery of the state-of-the-art education mainly focusing on development of trained and skilled human resource in the field of Animal Sciences and allied disciplines through quality teaching and research. Department of Animal Sciences intends to develop and foster innovative research skills and teaching programs keeping in view the ever-increasing challenges of the contemporary world and needs of the society and the environment. There are five (05) faculty members, three (03) of them are doctorate and two (02) have M.Sc. (Hons.)/M.Phil. degree in various fields of Animal Sciences, among them one (01) Professor, one (01) Associate Professor, one (01) Assistant Professors and two (02) are Lecturers. The Department has produced more than 300 undergraduate students and 170 postgraduate students since its inception in 2010. The Department has three (03) state of the art labs, equipped with advanced and latest equipment, essentially required for field experimentation, together with vast research area and a University Veterinary Hospital. The Department is seeking links and collaborations with renowned national and international sister animal/veterinary research and educational institutions for faculty and students exchange program, which will further refine the skills and qualifications of the faculty as well as students.

3. **Program Learning Objectives:**

1. Prepare students for professional careers in animal sciences sector on modern lines with ample practical knowledge and advanced sustainable animal production and management skills, a standard identical to accredited international standards
2. Develop basic problem-solving skills in students and train them about various techniques and methods for the improvement of production and management of animals.
3. Create leaders in Animal Sciences and allied natural resource management disciplines both nationally and internationally
4. To strengthen existing linkages between local, regional, national and international institutions/organizations related to animal/veterinary research and education

4. **Scope and Career Prospects:**

This M.Phil. Program in Animal Sciences is designed for the students who have qualified BSc. Honors or equivalent degree in Animal/Veterinary sciences-related fields and are interested in pursuing research based animal sciences at a level beyond 16 years of education. The overall objective of this program is to develop researchers in the field of Animal Sciences with multidisciplinary approach with the vision, knowledge, creativity and research skills necessary to understand and solve the problems faced by animal industry. The graduates will be eligible and able to join following sectors for employment:

- Federal Government Departments and Divisions
  - Ministry of Climate Change and Environmental Coordination
  - Capital Development Authority
  - Pakistan Zoological Survey
  - Pakistan Agriculture Research Council
- Provincial Government Departments (Punjab, KPK, GB, Baluchistan etc)
  - Wildlife, Zoo and Safari's
- Non-Governmental Organization (NGOs)
  - International
  - National

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- Private enterprises
- Teaching and Research

5. **Program Structure:**

Duration	Minimum 2-Years (4-Semesters), Maximum 4-Years (8-Semesters)
Entry Requirements:	1- Candidates having Bachelor of Science (Hons.) degree in Animal Sciences / DVM / B.Sc. (Hons.) Dairy Sciences/ B.Sc. (Hons.) Poultry Sciences / B.Sc. (Hons.) Animal Husbandry degree (4-years) from any HEC recognized degree awarding Institutions with minimum CGPA 2.5/4.0 (16 years of education) 2- Pass university entry test/GRE-subject/HAT/GAT with 50% marks
Intra-disciplinary fields allowed for admission	Not Applicable
Degree Completion Requirements:	Total Credit Hours of Course Work: 26 Total Credit Hours of Thesis 06 Total Credit Hours of Program: 32
Program Mode (select one)	Thesis Track
Specialization (if any)	Not Applicable

6. **List of Deficiency Courses of Level-6:** *(for intra-disciplinary admissions only)*

Sr. No.	Course Code	Course Title	Credit Hours	Prerequisite
1.	Nil	Nil		Nil

7. **List of Mandatory/Compulsory/Core Courses:**

Sr. No.	Course Code	Course Title	Credit Hours	Prerequisite
1.	ANSC-7101	Research Methods in Animal Sciences	3(2-1)	Nil
2.	ANSC-7102	Current Issues and Innovations in the Animal Industry	3(2-1)	Nil
3.	ANSC-7103	Special Problem	1(1-1)	Nil
4.	ANSC-7104	Seminar-I	1(1-1)	Nil
5.	STAT-7153	Statistical Methods for Animal Sciences Research-I	3(3-0)	Nil
6.		Thesis	6(0-6)	Nil

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8. **List of Elective Courses:**

Sr. No.	Course Code	Course Title	Credit Hours	Prerequisite
1.	ANSC-7105	Introductory Microbiology	3(2-1)	Nil
2.	ANSC-7106	Advanced Microbiology (General)	3(2-1)	Nil
3.	ANSC-7107	Cellular and Molecular Immunology	3(2-1)	Nil
4.	ANSC-7108	Advanced Bacteriology	3(2-1)	Nil
5.	ANSC-7109	Advanced Virology	3(2-1)	Nil
6.	ANSC-7110	Mycology	3(2-1)	Nil
7.	ANSC-7111	Microbial Physiology	3(2-1)	Nil
8.	ANSC-7112	Public Health Microbiology	3(2-1)	Nil
9.	ANSC-7113	Dairy Microbiology	3(2-1)	Nil
10.	ANSC-7114	Physiological and Biochemical Basis of Nutrition	3(3-0)	Nil
11.	ANSC-7115	Feed Resources and their Nutritive Value	3(2-1)	Nil
12.	ANSC-7116	Vitamins in Nutrition	3(3-0)	Nil
13.	ANSC-7117	Minerals in Nutrition	3(2-1)	Nil
14.	ANSC-7118	Analytical Techniques in Nutrition	4(0-4)	Nil
15.	ANSC-7119	Nutrition of Broilers	3(2-1)	Nil
16.	ANSC-7120	Nutrition of Layers	3(2-1)	Nil
17.	ANSC-7121	Nutrition of Dairy Animals	3(2-1)	Nil
18.	ANSC-7122	Poultry Feeds and Nutrition	3(0-3)	Nil
19.	ANSC-7123	Ruminant Nutrition	4(3-1)	Nil

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Scheme of Studies M.Phil. Animal Sciences

Semester-I

Sr. #	Category	Course Code	Course Title	Credit Hours	Pre-requisite
1	Compulsory-1	ANSC-7101	Research Methods in Animal Sciences	3(2-1)	Nil
2	Compulsory-2	ANSC-7102	Current Issues and Innovations in the Animal Industry	3(2-1)	Nil
3	Elective-1	ANSC-71xx	To be selected from list	3 (x-x) or 4(x-x)	Nil
4	Elective-2	ANSC-71xx	To be selected from list	3 (x-x) or 4(x-x)	Nil

Semester credit hours: 12-14

Semester-II

Sr. #	Category	Course Code	Course Title	Credit Hours	Pre-requisite
	Compulsory-3	STAT-7153	Statistical Methods for Animal Sciences Research-I	3(3-0)	Nil
2	Elective-3	ANSC-71xx	To be selected from list	3 (x-x) or 4(x-x)	Nil
3	Elective-4	ANSC-71xx	To be selected from list	3 (x-x) or 4(x-x)	Nil
4	Elective-5	ANSC-71xx	To be selected from list	3 (x-x) or 4(x-x)	Nil

Semester credit hours: 12-15

Semester-III

Sr. #	Category	Course Code	Course Title	Credit Hours	Pre-requisite
1	Compulsory-4	ANSC-7103	Special Problem	1(1-0)	Nil
2	Compulsory-5	ANSC-7104	Seminar-I	1(1-0)	Nil

Semester credit hours: 02

Semester-IV

Sr. #	Category	Course Code	Course Title	Credit Hours
1	Compulsory		Thesis	6(0-6)

Semester credit hours: 06

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Detailed Contents of Mandatory/Compulsory/Core Courses

ANSC-7101 **Research Methods in Animal Sciences** **3(2-1)**

The course provides the students theoretical and practical knowledge about research methods and techniques being used for the advancement of animal industry. This course is concerned with understanding and application of, the scientific method in biological research, and in particular, the animal sciences. The course has a foundation in the philosophy of science. Particular emphasis is given to the application of statistical hypothesis testing, which is explored in a series of case studies. In addition, research skills in proposal preparation, project management, teamwork, presentations skills and publication writing are developed in the context of scientific research. Research methods in animal science designed to covers major topics in: definition of Research, defining research problems, identifying and Prioritizing Research Needs. , Principles of Research, Steps in Scientific Research, Types of Research, Sampling and data collection Methods Purposes of writing Proposal, General Components of a Research Proposal and scientific papers like Introductory Section, Review of Related Literature, Materials and Methods, Work plan and Budget, Bibliography/Literature Citations, Data analysis and presentations, introduction of software like SPSS and SAS, Discussion on sample proposals and papers

Contents

Theory

1 Identification of current issues/problems related to animal industry
2 Research proposal writing in animal sciences
3 Study design in animal sciences
4 Experimental design in animal sciences
5 Sample size and power
6 Data analysis
7 Scientific writing skills
8 Ethics in experimenting on animals

Practical

1 Case studies related to current issues in Animal Sciences.
2 Writing a Research Proposal, Articles and Manuscripts.
3 Care and management of animals during research Project.

Recommended Texts

1 Thomas, C.G. (2021). *Research Methodology and Scientific Writing* (2nd ed.). Springer, Cham.
2 Boniface, D.R. (195). *TExperiment Design and Statistical Methods.* Chapman & Hall USA.

Suggested Readings

1 Gijsbers, G. Willem, J., Helen, H.O. & Gerdian, G. (2001). *Planning Agriculture Research.* CABI publishing UK.
2 Richard E. M., & Patricia A. A. (2018). *I Handbook of Research on Learning and Instruction.* Routledge UK.

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Suggested Readings

1 Gijsbers, G. Willem, J., Helen, H.O. & Gerdian, G. (2001). *Planning Agriculture Research.* CABI publishing UK.
2 Richard E. M., & Patricia A. A. (2018). *I Handbook of Research on Learning and Instruction.* Routledge UK.

ANSC-7102 **Current Issues and Innovations in the Animal Industry** **3(2-1)**

This course will introduce students to the breadth and scope of animal agriculture in Pakistan with emphasis on food producing animals. Additionally, fiber producing animals, pets, pleasure animals, and alternative livestock will also be studied. Students will be exposed to biological concepts and their relationship to contemporary production systems, economics, terminology and industry issues to enhance understanding of and appreciation for various uses of animals in North America. The course is available in a web-based format with extensive use of video tours of animal housing facilities, expert interviews, and explanations of the biology behind common production and food safety practices.

Contents

Theory

1 Significance and challenges of animal industry
2 Beef cattle production
3 Muscle biology and meat quality
4 Lactation and management of dairy cattle
5 Sheep and goat production
6 Poultry production
7 Production of transgenic animals
8 Fermentation techniques in feed production
9 Manure utilization in production system
10 Management of animal diseases in livestock production

Practical

1 Demonstration of modern management tools/equipment in animal production system.
2 Use of software and computer/mobile apps in animal industry
3 Disease surveillance at farm level

Recommended Texts

1 Fuller B., Cliff Lamb, G. & Wu, G. (2019). *Animal Agriculture.* Elsevier.
2 Yucel, B. & Turgay, T. (2018). *Animal Husbandry and Nutrition*. IntechOpen. https://doi.org/10.5772/intechopen.69938.

Suggested Readings

1 Kyoung S. R., Ariel A. S. & Gilbert C. S. (2020). *Innovative Animal Manure Management for Environmental Protection, Improved Soil Fertility and Crop Production.* MDPI.
2 Webster, J., & Weber, R. (2007). *Introduction to Fungi.* UK, Cambridge University Press.
3 Jeff, A.Z. (2014). *The Innovation Animals: Nature's Framework for Innovation and Entrepreneurship.* Switzerland, Intech Open.

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ANSC-7103 **Special Problem** **1(1-0)**

The special problem is intended to instruct students on proper techniques for scientific research and methodologies. The students are expected to prepare directed assignment and collect information and material related to current research interest. Special problem means an assignment that is expected to be temporary and is designated as a special assignment by the academic supervisor in its sole discretion. The main purpose of special problem is to increase the learning capabilities of students. The more we use our brains, the more they develop. Students learn a lot more when they read or practice something by themselves. Similarly, the purpose of assignments is to increase the practical skills of students. The main objectives of special problem assigned to students are: to enhance the knowledge of a subject, helps to develop writing skills and to enhance time management and organizing skills. It enhances your planning and organizing skills: The special problem make you do your work by prioritizing the needs and time frames. It helps you in completing all your tasks very peacefully instead of creating any panic. Scopes for improvement: Special problem writing work gives students a lot of scopes to improve themselves.

ANSC-7104 **Seminar** **1(1-0)**

The seminar is intended to instruct students on proper techniques for presentation of scientific material. Each student is expected to prepare and present a scientific seminar and to submit written documentation supporting that seminar. A seminar is a form of academic instruction, either at an academic institution or offered by a commercial or professional organization. It has the function of bringing together small groups for recurring meetings, focusing each time on some particular subject, in which everyone present is requested to participate. Seminars provide a chance to interact with experts from the specific field. Discussing about the relevant topics of the particular subject, students tend to learn about the latest information and new skills related to the concerned subject. Seminars are important and beneficial for those who have difficulty learning in a typical classroom setting where reading and writing are required. There is often a sense of friendship associated with seminar attendance, because everyone is attending with a like interest in learning about a subject important to them. Attending a seminar has numerous benefits, including improving communication skills, gaining expert knowledge, networking with others and renewing motivation and confidence.

STAT-7153 **Statistical Methods for Animal Sciences Research-I** **3(3-0)**

This course designed for MSc (Hons)/MPhil programs of animal sciences. This course provides the applied statistics background for survey and experimental work in Animal Sciences. Case studies and critical examples are used to work through commonly experienced research problems (from sampling designs to the ethical consideration) and to explain how they may be approached, solved or prevented with statistical means. The importance of statistical science in animal sciences research is obvious, where the collection, analysis and interpretation of numerical data are concerned. Statistical principles apply in all areas of experimental work and they have a very important role in animal related experiments. Statistics plays an important role in experimentation. While many scientific problems could be solved by different statistical procedures. Furthermore, some statistical softwares knowledge will be provided to the students to improve their analytical skills. These activities are further supports the student's research.

Contents

Theory

1. Introduction and Importance of Statistics in animal research
2. Hypothesis testing., Type-I error, Type-II error, z test, t-test (single sample, Paired sample and independent sample)
3. Basic principles of experimental design.
4. Layout analysis of CRD, RCBD, Latin Square Designs.
5. Inference after ANOVA.
6. Analysis of Count and Frequency data.
7. Chi-Square Test of Association and Proportion.
8. Correlation Analysis: Simple correlation and multiple correlation.
9. Regression Analysis: Simple and multiple regression.
10. Non-linear regression.
11. Logistic Regression.

Recommended Texts

1. Montgomery, D.C. (2017). *Design and analysis of experiments* (9th ed.). New York: John Wiley & Sons.
2. Rao, G.N. (2007). *Statistics for agricultural sciences* (2nd ed.). India, BS Publication.

Suggested Readings

1. Lawal, B. (2014). *Applied statistical methods in agriculture, health and life sciences*. USA: Springer.
2. Sahu, P.K. (2016). *Applied statistics for agriculture, veterinary, fishery, dairy and allied fields*. USA: Springer.
3. Gbur, E.E., Stroup, W.W., McCarter, K. S., Durham, S., Young, L. J., Christman, M., West, M. & Kramer, M. (2012). *Analysis of generalized linear mixed models in the agricultural and natural resources sciences*. USA: Soil Science Society of America.

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Detailed Contents of Elective Courses

ANSC-7105 **Introductory Microbiology** **3(2-1)**

The main aim of this course is to understand the importance of microorganisms. Understand the structure, functions, nutrition, growth, metabolism, evolution, taxonomy, diversity, and chemotherapy of microorganisms. Use the techniques to deal with the safe culturing, detection, and typing of microbes. This course will provide a detailed knowledge to students about the taxonomy and distribution of microbes across the regions and also the effects of microbes on biosphere. Moreover, microbial structures and taxonomy is also the main content of the course. The focus of this course is also to discuss physiology of microbes and their identification. Moreover, advanced techniques for the diagnosis and purification of microorganisms will be transferred to students during practical classes. The students will also gain expertise for newly emerging trends microbiology.

Contents

Theory

1 The Study of microbial structure;
2 Prokaryotic cell structure and function; Eukaryotic cell structure and function;
3 Microbial nutrition; Microbial growth; Microbial metabolism; Microbial genetics;
4 Control of microorganisms by physical and chemical agents;
5 Microbial evolution, taxonomy, and diversity;
6 The archaea; The protists; Characteristics of viruses;
7 The fungi (Eumycota);
8 Biogeochemical cycling and introductory microbial ecology;
9 Microbial interactions; Nonspecific (innate) host resistance; Specific (adaptive) immunity;
10 Pathogenicity of microorganisms; Chemotherapy; Role of microbes in industry.

Practical

1 Preparation and maintenance of culture media; selective, enrichment and differential media.
2 Culturing of microbes and their stock management;
3 Cultural, Morphological and Biochemical characteristics;
4 Typing of pathogens; sero types, Phage types and Patho types;
5 Genetic detection (bacterial, viral and mycotic arrays) applied to study pathogens.

Recommended Texts

1 Camille, L. and M. Simonet, 2012. Bacterial Pathogenesis: Molecular and Cellular Mechanisms. Caister Academic Press, UK
2 Cappuccino J.G. and N. Sherman, 2004. Microbiology: A Laboratory Manual. Pearson Education, NJ, USA

Suggested Readings

1 Talaro, K.P. and A. Talaro, 2002. Foundation in Microbiology. McGraw Hill, New York, USA
2 Tortora, G.J., B.R. Funke and C.L. Case, 2004. Microbiology - An Introduction, 8th Ed., Pearson Edu. Inc., California, USA
3 Willey, J.M., L.M. Sherwood and C.J. Woolverton, 2008. Prescott, Harley, and Klein's Microbiology. 7th. Ed. Mc Graw Hill, New York, USA.

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ANSC-7106 **Advanced Microbiology (General)** **3(2-1)**

The main focus of this course is to study in details the morphology, the culture, spread, biochemical activities, antigenic characters, pathogenesis, laboratory diagnosis, treatment& prevention &control measures of each bacteria. Define the organs commonly involved in the infection. Recall the relationship of infection to symptoms, relapse and the accompanying microbiology. The students will gain knowledge of microbiology and allied field of studies such as, pathogenic bacteria and beneficial bacteria. Ecology and spread of bacteria as plant, animal and human pathogens. The survival mechanisms and communication between microbes will also be studied during the course. The students will go through the important microbial diseases and management approaches. During the practical classes, students will learn the basic to advanced techniques to study microbial isolation and biochemical assays for identification.

Contents

Theory

1 Introduction to pathogenic bacteria of man, animal and plant.
2 Gene expression and their regulation, genetic transfer, the synthesis of macromolecules,
3 Molecular aspects of pathogenicity and virulence,
4 Interrelationship of DNA, RNA and protein biosynthesis, regulation of DNA and RNA,
5 Study of virulent factors of pathogen at molecular level,
6 disease signature of pathogens (*Mycobacterium tuberculosis*, *Staphylococcus aureus*),
7 Microbial pathogenesis in major infectious diseases at molecular level,
8 Recent advancements of pathogens for immune system evasion, emerging infectious agents,
9 Toxins acting on intracellular targets cellular invasion by bacterial pathogens,
10 Bacterial evasion of host defense.
11 Bacteria-induced host cell death. Biofilms: the molecular mechanism of microbial colonization.
12 Clinical, immunological aspect and therapy: Staphyloccocal, Streptococcal, Clostridial, Bacillus, Pasteurella and Diphtherial toxins.

Practical

1 Culturing of pathogens and their stock management,
2 Detection and genotyping of microorganisms, Typing of pathogens based on 16s RNA,
3 Chip techniques (bacterial, viral and mycotic arrays) applied to study pathogens,
4 Study of microbial metabolites, assessment of microbial biodiversity.
5 Molecular identification of specific virulent microbial factor. Toxins neutralization assay.
6 Evaluation of specific biofilm forming bacterial culture from various environments
7 Whole genome sequencing: an overview.

Recommended Texts

1 Camille, L. and M. Simonet, 2012. Bacterial Pathogenesis: Molecular and Cellular Mechanisms. Caister Academic Press, UK.
2 Molecular Pathogenesis, Bruce A McClane, 2010, 2nd Edition, Integrated medical scinces series.

Suggested Readings

1 Tortora, G.J., B.R. Funke and C.L. Case, 2004. Microbiology- An Introduction. 8th Ed., Pearson Edu. Inc., California, U.S.A.
2 Cappuccino J.G. and N. Sherman, 2004. Microbiology: a laboratory manual. Pearson Education., NJ, USA.
3 Talaro, K.P. and A. Talaro, 2002. Foundation in Microbiology. McGraw Hill., New York, USA.

ANSC-7107 **Cellular and Molecular Immunology** **3(2-1)**

The main aim of this course is to provide students with detailed knowledge of the cells and organs of the immune system, their organization and diversity, and their specialized functions at different anatomical locations. Student should be able to understand cross talk of immune cell receptors and cytokines in cellular interactions and co-ordination of immunological mechanisms. In addition, the course explores how immune regulatory molecules can be designed/manipulated for use in vaccines, immunotherapy of disease and selection of animals.

Contents

Theory

1 General overview of immune system: background and history of immune system;
2 Specific components of immunity;
3 Antibody and antigen;
4 Cell mediated immunity;
5 Co-stimulation and T cell activation: the B7/CD28/CTLA-4 pathway;
6 Peripheral tolerance; Regulatory lymphocytes I; Regulatory lymphocytes II;
7 Apoptosis in the microenvironment of inflamed tissue,
8 Chemokines and inflammation, Cytokines-Th1, Th2 and Th17 profiles,
9 Cytokines in autoimmunity,
10 Immunodeficiency diseases,
11 Immunochemistry: A brief introduction; Recent advances in molecular immunology

Practical

1 Isolation of immune cells from blood;
2 Stimulation of immune cells and expression measurement of inflammatory markers;
3 Tests for phagocytosis; tests for ROS production; antimicrobial peptides isolation;
4 Determination of immunocompetence (cellular and humoral);
5 Serological Tests; Purification of antibodies; Serum preparation; Serology: medico-legal studies,
6 Immunological Assays;

Recommended Texts

1 Immunobiology, 5th edition; The immune system in health and Disease. Charles A Janeway, Jr, I Paul Travers, 2 Mark Walport,3 and Mark J Shlomchik 1. ISBN-10:0-8153-3642-x.
2 Tizzard, I. R., 2009. Veterinary Immunology -An Introduction. 8th Ed., W. B. Saunders Co., London, UK.

Suggested Readings

1 Veterinary Immunology, Principals and Practice: Michael Day, Menson Publishers, 2nd edition, 2010.
2 Kuby, J., 2006. Immunology. 6th Ed., W.H. Freeman and Co., New York, USA.
3 Jawetz, Melnick, and Adelberg's, 2001. Medical Microbiology. Geo F. Brooks, A. Stephen Morse, Janet Butel and Janet S. Butel. McGraw-Hill Companies. New Jersey, USA.

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ANSC-7108 **Advanced Bacteriology** **3(2-1)**

The main focus of this course is to learn the properties and technical cultural, morphological and molecular characteristics essential for the identification of Gram positive, Gram negative, aerobic and anaerobic bacteria. Students will gain understanding and awareness of anaerobic bacteria, their antibiotics resistance and diagnosis. This course will enable students to become competent enough to deal with the collection, examination and the identification of normal bacterial micro-flora from the environment, healthy and disease specimen.

Contents

Theory

1 Bacterial classification; Methods for isolation of culture from different environment
2 Introduction to anaerobic microbiology; Anaerobic versus aerobic bacteria;
3 Biochemistry and Physiology of bacteria;
4 Chemical and fuel production by anaerobic bacteria;
5 Industrial importance and applications of anaerobes;
6 Exploitation of anaerobic bacteria as probiotics; Antigenic structures and pathogenicity;
7 Systematic bacteriology with special reference to pathogenic bacteria;
8 Molecular diagnostic approach in bacterial infections;
9 Principals of chemotherapy;
10 Detailed characteristic studies on; Actinobacillus; Erysipelothrix and Listeria; Mycobacterium; Coryneabacterium; Fusiformis; Pfeiferella; Vibrio; Neaisseria; *Streptococci*; *Staphylococci*; Coliform; Proteus; and Klebseilla; Pseudomonas and Bukhudaria; Salmonella; Pasteurella; Heamophillus; Bacillus; Brucella and Bordetella; Actinomyces; Clostridium; Fusobacterium; Veillonella; Bifidobacterium; Sprichaetes; Treponemataceae; Borrelia, Leptospria and Tryponema, Ureaplasma and Mycoplasma groups of organisms.

Practical

1 Personal safety and hazard in bacteriology Laboratory;
2 Demonstration of isolation; purification and identification of bacterial spp. from various specimens collected from environment, water, soil, hospital etc;
3 Cultivation methods/systems for anaerobes
4 Demonstration of latest molecular diagnostic techniques including PCR and microarray system.

Recommended Texts

1 Krieg,N,R., J, T. Staley, D, R. Brown, B. P. Hedlund, B. J. Paster, N. L. Ward, Wolfgang L and W.B. 2010 Whitman Bergey's Manual of Systematic Bacteriology 2nd Edition Vol 1and 4. Springer, New York USA ISBN 0-387-95042-6
2 Pearmain,T. H and C.G. Moor 2010 Applied Bacteriology; an introductory Handbook.Nabu Press.N.Y., USA

Suggested Readings

1 Sturuthers, J.K and R.P. Westran 2003 Clinical Bacteriology. Manson Publishing Ltd Bristle, UK
2 Duerden, B. I. 2004, Topley & Wilson's Microbiology and Microbial Infections, Volume 2: Systematic Bacteriology. Hodder Arnold Publication New York USA (ISBN: 0340663170 / 0-340-66317-0)
3 Woodford, N and A. P. Johnson 2004 Genomics, Proteomics and Clinical Bacteriology Vol 226 Methods and reviews in Methods in Molecular Bacteriology. Humana Press.N.Y., USA.

ANSC-7109 **Advanced Virology** **1(1-0)**

The special problem is intended to instruct students to learn the properties and technical cultural, morphological and molecular characteristics essential for the identification of viruses. Students will gain understanding and awareness of genetic mechanisms of virus replication and virulence. This course will enable students to become competent enough to diagnostic techniques, mechanisms of viral diseases and their treatment/prevention. In practical the students will be trained for isolation, identification and classification of different viruses. Safe laboratory practices will be explained and adopted to deal with virulent viruses. Modern cultural techniques will be taught to students.

Contents

Theory

1 Origin and nature of viruses; classification and basis of classification;
2 Size and morphology of virus particles; electron microscopy of virus particles.
3 Techniques of isolation, purification and identification of viruses;
4 Serological properties of viruses; cultivation of viruses in chicken embryos and tissue culture.
5 Virus multiplication and variation;
6 Genome replication strategies;
7 Processing of viral pre-mRNA; RNA virus Genome replication and mRNA production;
8 Reverse Transcription and Integration; bacteriophage-becterium system;
9 Virus-host interaction; interference phenomenon, interferon; viral immunity;
10 Chemotherapy of viral infections, Mechanism of antiviral drugs.
11 Virus inhibiting analogues; amino acid analogues; protein in inhibitors.
12 Plant and insect viruses. Viruses and Cancer.
13 New and Emergent Viruses. Ds DNA viruses; ssDNA viruses; dsRNA viruses; Zoonoses.
14 Subviral Agents, Genomes without Virus, Viruses without Genomes, Satellites, Viroids, Prions.

Practical

1 Assay for bacteriophage; infectivity assay of animal viruses; cultivation of viruses in laboratory;
2 Cytopathogenesis of viruses. (LD 50 determination)
3 Assays in Virology.

Recommended Texts

1 Alan J. Cann., 2010. Principles of Molecular Virology, 5th Ed. Elsevier Academic press, California,USA.
2 Leonard C. Norkin., 2010. Virology: Molecular Biology and Pathogenesis. ASM Press, Washington, DC, USA.

Suggested Readings

1 S. J. Flint, L. W. Enquist , V. R. Racaniello, A. M. Skalka, 2009. Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses. ASM Press, Washington, DC, USA.
2 Nicholas H. Acheson., 2007. Fundamentals of Molecular Virology, 1st Ed. John Wiley & Sons, Inc. Publ., New York, USA.

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ANSC-7110 **Mycology** **3(2-1)**

To study taxonomy and nomenclature of fungi and fungi-like organisms of agricultural importance. The kingdom Protista and its significance and nomenclature will provide detail information on fungal systematics. Furthermore, importance and life cycle of pathogens. During the practical, collection, preservation and identification of mycological specimens and use of key for identification of fungi is the main concern of the course. Moreover, keys for the identification of different fungi is also included in the course. The students will be able to identify and classify the fungi at the end of the course.

Contents

Theory

1 Fungi, their general characteristics and classification.
2 The diversity of fungi and fungus-like organisms.
3 Fungal structure and ultrastructure.
4 Fungal nutrition, growth and differentiation.
5 Fungal metabolism and fungal products obtained through fermentation and biotechnology.
6 Fungal Ecology: Saprotrophs, symbionts and pathogens of plants, insects, animals and humans.
7 Pathogenic fungi and their role in causation of superficial, deep seated.
8 Principles and the practice of controlling fungal growth. Antifungal drugs and their mechanism;
9 Fungal genetics, molecular genetics and genomics.
10 Role of fungi in Biotechnology. Myco-nanotechnology.

Practical

1 Demonstration of cultural characteristics,
2 Reproduction, identification and classification yeasts and molds of general and medical importance.
3 Methods of preservation of fungi.
4 Determination of anti-fungal activity of substances.
5 Molecular identification of fungi with special reference to disease diagnostic and treatment.

Recommended Texts

1 Deacon, J. (2010). Fungal Biology. Blackwell Publishing, Oxford, UK.
2 Bilgrami, K.S. and R.N. Verma. (1981). Physiology of fungi pp 207. Vikas Publishing House Pvt. Ltd. Delhi (India).

Suggested Readings

1 Rai, M., P.D. Bridge (2009). Applied Mycology. CAB International. Baltimore USA.
2 Javed Aziz Awan and Sajjad-ur-Rahman. 2005. Manual. of Microbiology 2nd Edition Unitech Communication, Faisalabad. Pakistan
3 Anaissie, E.J., M.R. McGinnis and M.A. Pfaller. (2009) Clinical Mycology. 2nd Ed. Churchal Livingstone. Elsevier.NewYork USA.

ANSC-7111 **Microbial Physiology** **3(2-1)**

The main focus of this course is to develop an understanding of the cellular and intracellular organization of the microbial cells. Understand how microbes transport major and minor nutrients for cellular growth and differentiation? Key Enzymes and Metabolic pathways that enable microbes to grow and outcompete other organisms under a variety of favorable and adverse environmental conditions including extremes of temperature, pressure, moisture, ionic concentrations etc.

Contents

Theory

1. Microbial Cell Structure and Function;
2. Macromolecular Synthesis of DNA, RNA and Protein; Structural Assembly, Bacterial growth;
3. Environmental effects; Enzymes and Energy Production; Physiological adaptation;
4. Mutation and adaptation, Respiration and Fermentation. Gene expression, regulation and control,
5. Microbial nutrition and growth, microbial metabolism, energy, enzymes, pathways and regulation.
6. Energy and work, the laws of thermodynamics, role of ATP in metabolism,
7. Energy Release and Conservation:
8. Overview of metabolism, the breakdown of glucose to pyruvate. Fermentation reactions.
9. TCA cycle, the electron transport and oxidative phosphorylation, anaerobic respiration,
10. Use of energy in biosynthesis, principles governing biosynthesis.
11. The photosynthetic fixation of CO_2. The synthesis of sugars and polysaccharides.
12. Assimilation of inorganic phorphorous, sulfur and Nitrogen.
13. The synthesis of Amino Acids. Anaplerotic reactions.
14. The synthesis of purines, pyrimidines and nucleotides. lipid synthesis, peptidoglycan synthesis,
15. Microbial ecology & cell to cell communications (quorum sensing and quorum quenching).
16. Symbiotic interactions, parasitism. Microbial evolution and biodiversity:
17. Microbial infractions in extreme environments, loss and maintenance of biodiversity.

Practical

1. Microbial assays, General applications and their practical significance,
2. Bacterial growth cycles and measurement of bacterial growth dynamics, analysis of microbial growth data,
3. Nutrient limited growth and growth stimulation by nutrient supplementation,
4. Design and optimization of growth media.

Recommended Texts

1. Dawes, I.W. and I.W. Sutherland (1992). Microbial Physiology 2nd Edition. Blackwell Scientific Publishers Ltd. London. (ISBN: 0632024631).
2. Presott, L.M., J.P. Hartley and D.A. Klein (2005). Microbiology, Sixth Edition. pp. 992. Mc Graw Hill International (Boston, U.S.A.) (ISBN 607-122834-9).

Suggested Readings

1. Tortora, G.J., B.R. Funke, C.L. Case (2001). Microbiology, an Introduction. 9th Edition. pp. 958 Benjamin Cummings (Pearson) Publishers, USA. (ISBN-10: 0805375546).
2. Caldwell, D.R. (1999). Microbial Physiology and Metabolism, pp. 384. Star Publishing Company, (ISBN: 0898632080).

ANSC-7112 **Public Health Microbiology** **3(2-1)**

The main aim of this course is to understand the scope and concepts of public health microbiology. Have the knowledge of microbial diseases of public importance transmitted through water, food, dairy products, meat, eggs, vegetables, fruits, air etc. Apply the knowledge for control of microbial disease in the population. Concept of one health and importance of animals and animal's product in one health, this course will impart knowledge of food security and significance of animals and animal's products in disease control and public health.

Contents

Theory

1. Scope of public health microbiology; water-borne microbial diseases and their control;
2. Use of microbes in waste water treatment; role and significance of microorganisms in food;
3. Food-borne microbial diseases and their control;
4. Bacterial, viral and fungal diseases transmitted through animal's products and their control;
5. Role of vaccines in public health; sexually transmitted microbial diseases and their control;
6. Air-borne microbial diseases; Vector-borne microbial disease;
7. Bacterial, viral and fungal diseases of zoonotic importance;
8. Nosocomial infections; Bioinformatics and public health microbiology.

Practical

1. Identification of microorganisms and/or their products in food, dairy products, meat, eggs, vegetables, fruits and air;
2. Detection of antibiotic residues in foods; Demonstration of food and water sanitation.

Recommended Texts

1 Burlage, R.S., 2011. Principles of Public Health Microbiology. Jones and Bartlett Learning, Canada.
2 Harrigan, W., 1998. Laboratory Methods in Food Microbiology. Academic Press, U.K.

Suggested Readings

1 Jay, J. M., M. J. Loessner, and D. A. Golden, 2005. Modern Food Microbiology. 7th. Ed. Springer Science Publishers, U.S.A.
2 Manwar, A. W. 2010. Air Microbiology: An environmental and Health Perspective. Cinnamonteal Print and Publishers, GOA.
3 Spencer, J. F. T. and A. L. R. Spencer, 2010. Public Health Microbiology: Method and Protocols. Humana Press, Totowa, New Jersey.

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ANSC-7113 **Dairy Microbiology** **3(1-2)**

On completion of this course, students should be able to analyze and differentiate the interrelationships of microorganisms. To predict the impact of milk processes and handling on the microbiology of milk & milk products. To develop advanced success skills including critical thinking, professionalism in dairy industry.

Contents

Theory

1. Microorganisms in dairy industry, dairy animals, dairy environment:
2. Bacteria, yeast and molds morphology, taxonomy and physiology:
3. Microbiology of raw, pasteurized, UHT and concentrated milk, milk powders, whey, butter, yoghurt, cheese, indigenous products, ice cream and frozen desserts;
4. Srarter cultures and their uses; Probiotics and Prebiotics;
5. Pathogens in milk and milk products;
6. Advanced microbiological and molecular techniques for the examination of milk and milk products;
7. Selective identification; Public health concerns;
8. Microbes used in the preparation of various dairy products;
9. Control of microorganisms involved in processing of dairy products.
10. Dairy waste and treatment;
11. Microbial quality, spoilage and safety of dairy products.

Practical

1. Collection and transportation of samples of milk and milk products:
2. Microbiological techniques: Dairy micro biota: TPC, yeast and molds, somatic cell counts,
3. Coliforms, Mesophillic aerobic microorganisms:
4. Microbiological assays for detection of aflatoxins and drugs residues in milk and dairy products.

Recommended Texts

1. Elmer, H.M. and JL Steele (Ed) 2001. Applied Dairy Microbiology, 2nd Ed. Marcel Dekker Inc. London,UK.
2. Parihar, P. and L. Parihar, 2006. Dairy Microbiology. Bharat Printer Press, Jodhpur, India.

Suggested Readings

1. Pommerville, J.C and I.E.Alcamo 2005 Alcamo's Laboratory Fundamentals of Microbiology. Jones and Bartlett Publisher International, London, UK
2. Robinson, R. K.. 2002. Dairy microbiology handbook: microbiology of milk and milk products. 3rd Ed. John Wiley & Sons, New York .USA
3. Pommerville, J.C 2011 Alcamo's Fundamentals of Microbiology Jones and Bartlett Publisher International, London, UK.

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ANSC-7114 Physiological and Biochemical Basis of Nutrition 3(3-0)

This postgraduate level course focuses mainly on the chemical basis of nutrition and biochemical and physiological processes that are involved in nourishment of body. It elaborates how food and its components are utilized and why nutrients are essential for life. This course tells about functions of essential nutrients like proteins, fat, carbohydrates, vitamins and minerals. It also studies details of inter-conversion of nutrients and hormonal regulation of different biochemical processes. After taking this course students will be able to deeply understand basal body metabolism which is required for life and ways to estimate nutrient requirements.

Contents
Theory

1. Chemistry of essential nutrients and their functions
2. Biochemical and physiological basis of nutritional requirements
3. Digestion and absorption of nutrients in gastro-intestinal tract
4. Metabolism of water, carbohydrates, lipids, proteins, minerals and vitamins
5. Hormonal regulation of metabolism and intermediary metabolism
6. Nutrients need, calorimetry and basal metabolism

Recommended Texts

1. Guyton, A.C. (2007). *Text book of Medical Physiology*. W.S. Saunders Co., Philadelphia, USA.
2. Lehninger A. L., Nelson, D.L.& Cox, M.M.. (2004). Principles of Biochemistry 4th edition Worth Publishing.

Suggested Readings

1. Martin, D.W., Mayes, P.A. & Rodwell, V.M.. (1998). *Harper's Review of Biochemistry*. Lange Medical Publication, Maruzen, Asia, Singapore.
2. Robert K.M., Granner, D.K., Mays, P.A. & Rodwell, V.M.. (2003). *Harper's Illustrated Biochemistry*, 26th edition. Longe Medical Publication.
3. Sarwar, M. & Chaudhry, S.A.. (2000). *The Rumen: Digestive Physiology and Feeding Management.* Univ. of Agriculture Press, Faisalabad.

ANSC-7115 Feed Resources and their Nutritive Value 3(2-1)

This course tells about types, availability pattern and characteristics of feed resources of Pakistan. It also critically studies nutrient composition, utilization and significance of different feed stuffs used locally for feed manufacturing of livestock commercial poultry.

Contents
Theory

1. Feed resources of Pakistan
2. Classification, availability, requirements, dynamics and characteristics
3. Nutritive value of feedstuffs and factors affecting nutritional quality of feeds in livestock and poultry Feeding standards and their application. Strategic supplementation
4. Associative effects of feeds for livestock and poultry
5. Methods of improving nutritive value of feedstuffs
6. Feeding rumen bypass proteins and lipids
7. Utilization of NPN compounds in livestock feeds and its significance
8. Factors affecting voluntary feed intake
9. Significance of feed additives for livestock and poultry
10. Toxins and anti-Nutritional factors in feedstuffs

Practical

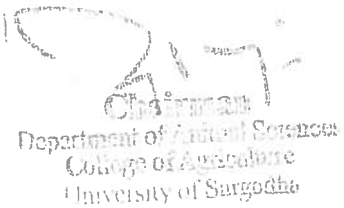
1. Chemical analysis, in-vivo, in-vitro and in-sacco techniques for feed evaluation
2. Techniques for estimation of feed toxins;Chemical and biological treatments of roughages
3. Preparation of hay and silage;Use of computer in feed formulation
4. Visits to feed mills, livestock farms and research institutes

Recommended Texts

1. Anonymous. (1989). *Feeding Standards of Pakistan*, PSI, Lahore
2. Cheeke, P.R. (2004). *Applied Animal Nutrition*, Feeds and Feeding. Delmar Publisher, Canada.

Suggested Readings

1. NRC. (2005). *Nutrient Requirements of Dairy Cattle*. National Academy Press, Washington, USA.
2. Perry, T.W., Cullison, A.E. & Lowrey, R.S.(1999). *Feeds and Feeding*. 5th Ed. Prentice Hall, New Jersey, USA.



ANSC-7116 **Vitamins in Nutrition** **3(3- 0)**

This postgraduate level course tells about significance of vitamins in nutrition of the animals. This course studies details of chemical nature of all water soluble and fat soluble vitamins and estimation of their quantity in animal feed.

Contents
Theory

1. History and development of the vitamin concepts and their classification
2. Fat-soluble vitamins: vitamin A, D, E and K; functions, deficiency, bioassay interactions with other nutrients, sources, requirements and hypervitaminosis
3. Water-soluble vitamins: vitamin B-complex and vitamin-C; functions, deficiency, sources, requirements and interrelationships with other vitamins and nutrients
4. Chemistry and metabolism of the fat soluble and water soluble vitamins and their roles in animals
5. Integrates cellular biochemistry and metabolism of the vitamins in the vertebrate animals
6. Stability of vitamins under different storage conditions

Practical

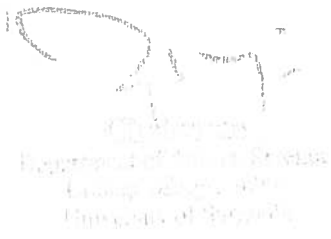
1. Analytical procedure for estimating vitamins in feedstuffs
2. Experimental procedure for inducing and correcting vitamins deficiency in birds
3. Vitmin composition of feeds;Preparation of vitamin supplements

Recommended Texts

1. McDonald, P., Edwards, R.A. & Greenhalgh, J.F.D. (1996). *Animal Nutrition*. Longman Scientific and Technical, Publisher, U.K.
2. McDowell, L.R. (2000). *Vitamins in Animal and Human Nutrition*. Academic Press Inc., Harcourt Brace Jovanovich, Publishers, London.

Suggested Readings

1. Sarwar, M. & Zia-ul-Hasan. (2000). *Nutrient Metabolism in Ruminants*. University of Agriculture Press, Faisalabad.



ANSC-7117 **Minerals in Nutrition** **3(2-1)**

This course tells about significance of minerals in animal nutrition. This course studies details of chemical nature of all macro and micro minerals and estimation of their quantity in animal feed.

Contents
Theory

1. Historical perspectives of minerals
2. Essential minerals and their classification, chemistry, functions, metabolism and interrelationships
3. Mineral absorption and role of chelating agents
4. Mineral imbalances, toxicity and deficiency symptoms
5. Mineral distribution in the animal body
6. Mineral requirements, sources, geographical distribution, deficiency and excess in Pakistan
7. Soil, plant and animal relationship
8. Problems associated with mineral nutrition
9. Role of minerals in growth, production and reproduction
10. Diagnosis, treatment and prevention of mineral deficiencies in livestock and poultry

Practical

1. Estimation of minerals in feed samples
2. Diagnosis of mineral disorders in farm animals
3. Formulation and preparation of mineral mixtures and licks

Recommended Texts

1. McDowell, L.R. (1992). *Minerals in Animal and Human Nutrition*. Academic press Inc. 1250 6th Avenue San Diego, California, USA.
2. O'Del, B.L. & Sunde, R.A. (1997). *Handbook of Nutritionally Essential Mineral Elements.* Marcel Dekker, Inc., New York, USA.

Suggested Readings

1. Sarwar, M. & Zia-ul-Hasan. (2000). *Nutrient Metabolism in Ruminants.* University of Agriculture Press, Faisalabad.
2. Underwood, E.J. (1999). *Mineral Nutrition of Livestock.* Acad. Press Inc. New York.

ANSC-7118 **Analytical Techniques in Nutrition** **4(0-4)**

This course is aimed at improving skills of students regarding feed analysis for different nutrient composition. Course focuses on various laboratory analytical techniques used in nutrition, maintenance of laboratory equipment and preparation of different chemical solutions for laboratory procedures.

Contents
Theory

1. Sampling of feeds for chemical analysis; preparation, grinding, labeling and preservation Maintenance of laboratory equipments and setting up a nutritional laboratory
2. Cleaning and washing of glasswares
3. Use of analytical balance
4. Preparation of buffers and determination of pH
5. Determination of dry matter by different methods (heat and toluene)
6. Analysis of neutral detergent fibre (NDF), acid detergent fibre (ADF), lignin and acid insoluble ash/silica
7. Preparation of samples for mineral analysis
8. Determination of anti-nutritional components in feedstuffs
9. Determination of nitrites and nitrates in forages
10. Screening of feeds for mycotoxins
11. Chemical analysis of blood, urine and milk

Recommended Texts

1. AOAC. (2006). *Official Methods of Analysis of the Association of Official Analytical Chemists*, 20th Ed. Arlington Virginia 22209.
2. FAO. (1995). *Tropical Animal Feeding*: A Manual for Research Workers, FAO, Rome, Italy.

Suggested Readings

1. ILCA. (1993). Feed Evaluation. International Livestock Centre for Africa, Addisababa, Ethopia.
2. Pomerans, & Melon, C. (1994). *Food Analysis*; Theory and Practice. Elsevier Publishers.
3. Van Soest, P.J. (1994). *Nutrition Ecology of Ruminants*. Cornell University, USA.

ANSC-7119 **Nutrition of Broilers** **3(2-1)**

This post-graduate level course critically focuses on nutrition of broiler birds to get optimum performance. It is aimed at production problems related to broiler nutrition and feeding standards of the broiler birds.

Contents
Theory

1. Digestion, metabolism and absorption of nutrients in broilers
2. Feed resources and their nutritional profile
3. Nutritional requirement of broilers
4. Effect of amino acid-energy ratio on growth of broilers
5. Essential amino acids and their role in broilers
6. Feed additives: Micronutrients and their role
7. Feeding program for broilers (starter, grower, and finisher) and broiler breeders
8. Nutrient adjustments during hot weather and stress
9. Nutrient deficiencies diseases and their prevention
10. Effect of nutrition on meat quality

Practical

1. Least cost feed formulation for different age groups of broilers and breeders
2. Physical evaluation of feedstuffs
3. Laboratory analysis of feeds and feed ingredients
4. Visits to commercial feed mills and commercial broiler/ breeder farms

Recommended Texts

1. Leeson, S. & Summers, J.D. (2001). *Scott's Nutrition of the Chicken*. International Book Distributing Co., Guelph, Ontario, Canada.
2. Leeson, S. & Summers, J.D., (2010). *Broiler Breeder Production*, Nottingham University Press, UK.

Suggested Readings

1. NRC. (1994). *Nutrient Requirements of Poultry*. 9th Ed. National Academy Press, Washington, DC, USA.
2. Leeson, S. & Summers, J.D., (2009). *Commercial Poultry Nutrition*, Nottingham University Press, UK.

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ANSC-7120 **Nutrition of Layers** **3(2-1)**

This post-graduate level course critically focuses on nutrition of commercial layers to get optimum egg production. It is aimed at production problems related to layer nutrition and feeding standards of the commercial layers and layer breeders.

Contents
Theory

1. Process of digestion and absorption of nutrients in layers
2. Nutrient requirements of commercial and breeder layers
3. Feed resources for layers and their nutritional profile
4. Feeding programs during brooding, growing and laying phases
5. Feed restriction: Nutrition of molted breeder and commercial layer flock
6. Effect of feed on egg quality and production
7. Effect of Ca:P and amino acid:energy on egg production
8. Role of feed additives in layer feeds
9. Nutritional deficiencies diseases in layers
10. Anti-nutritional factors in layer feed ingredients and their effects on layer performance
11. Feeding adjustments during hot climate
12. Pre-breeder and layer breeder nutrition
13. Effect of nutrition on egg quality

Practical

1. Evaluation of different types of layer feeds
2. Feed formulation and practical feeding program for breeder and laying flocks
3. Visits to breeder and commercial layer farms

Recommended Texts

1. Leeson, S. & Summers, J.D. (2001). *Scott's Nutrition of the Chicken*. International Book Distributing Co., Guelph, Ontario, Canada.
2. NRC. (1994). *Nutrient Requirements of Poultry*. 9th Ed. National Academy Press, Washington, DC, USA.

Suggested Readings

1. Leeson, S. & Summers, J.D. (2009). *Commercial Poultry Nutrition*, Nottingham University Press, UK.

ANSC-7121 **Nutrition of Dairy Animals** **3(2-1)**

This post-graduate level course is aimed at nutrition of dairy animals for better milk production and health. It focuses on milk production problems related to nutrition and process of ingestion, digestion and metabolism of different essential nutrients in dairy animals.

Contents
Theory

1. Digestive physiology: Digestion and absorption; Factors affecting digestion
2. Feed resources: Fodders, crop residues and concentrates
3. Nutritional requirements of different classes of dairy animals; Requirements for maintenance, growth, production, and reproduction
4. Feeding systems: Feeding on complete feed, fodder plus supplementation, silage, haylage and hay; Feed formulation for calves, heifers, dry, pregnant and lactating cows
5. Nutritional management of breeding bulls; Minerals and reproduction in dairy
6. Feeding of high yielding cows; Bypass proteins, lipids and feeding frequency
7. Feeding management of dairy animals under tropical conditions
8. Nutritional disorders and deficiency diseases
9. Nutrition and milk quality; Feed additives and feed supplements
10. Efficient usage of urea and other NPN sources in dairy feeding

Practical

1. Digestion trials; Measurement of digestion kinetics
2. Digestibility through indicator methods; Computerized feed formulation for different classes of animals; Hay and silage preparation.

Recommended Texts

1. Sarwar, M. & Chaudhary, S.A. (2000). *The Rumen: Digestive Physiology and Feeding Management.* Friends Science Publishers, Faisalabad.
2. Etgen, W.M. & Reaves, P.M. (1992). *Dairy Cattle Feeding and Management*. John Wiley & Sons, New York, USA.

Suggested Readings

1. Minson, D.J. (1990). *Forage in Ruminant Nutrition.* Harcourt Brae Jovanovich Publishers, New York, USA.
2. Ensminger, M.E., Oldfield, J.E. & Heinemann, W.W. (1990). *Feed and Nutrition Digest*. The Ensminger Publishing Company, Clovis, CA, USA.

ANSC-7122 **Poultry Feeds and Nutrition** **3(0-3)**

This post-graduate level course critically focuses on nutrition of poultry birds to get optimum performance. It is aimed at production problems related to poultry nutrition and feeding standards of the poultry birds. This course gives the knowledge about different poultry feeding methods and nutrient requirements of poultry birds raised for different purposes.

Contents
Theory

1. Digestion, metabolism and absorption of nutrients in poultry
2. Nutritional requirement of broilers, layers and breeders;Feed resources and their nutritional profile; Effect of amino acid – energy ratio on growth
3. Essential amino acids and their role; Feed additives, micronutrients (Vit. & Min.) and their role; Feeding program for broilers (starter, grower and finisher) and broilers breeders; Molting of layers and breeders
4. Feeding of poultry in hot weather and stress; Feeding of indeginous poultry, ducks, quails, geese turkeys etc.; Nutrient deficiencies / diseases and their prevention
5. Anti-nutritional factors in feedstuffs and their effects on brids performance; Effect of feed on meat and egg quality;Storage of feeds;Measure to avoid feed wastage
6. Recent trends in poultry nutrition, feed restriction; Water requirement, its quality and significance

Practical

1. Identification, classification & characterization of common feed ingredients
2. Least cost feed formulation for different age groups of boilers, layers and breeders
3. Physical evaluation of feedstuffs; Laboratory analysis of feeds and feedstuffs; Visits to commercial feed mills and poultry farms

Recommended Texts

1. Ensminger, M.E., Oldfield, J.E. & Heinemann, W.W. (1999). *Feeds and Nutrition Digest* (2nd Ed). The Ensminger Publishing Co., Clovis, California. USA.
2. Lesson, S. & Summers, J.D. (2001). *Broiler Breeder Production*. University Book, Guleph, Ontario, Canada.

Suggested Readings

1. Lesson, S. & Summers, J.D. (2002). *Scott's Nutrition of the chicken*. International Book Distributing Co. Guelph, Ontario, Canada.
2. Lesson, S. & Summers, J.D. (2005). *Commercial poultry Nutrition* University Books, Guleph, Ontario, Canada.

ANSC-7123 **Ruminant Nutrition** **4(3-1)**

This post-graduate level course is aimed at nutrition of ruminants for better performance and health. It focuses on production problems related to ruminant nutrition and process of ingestion, digestion and metabolism of different essential nutrients in ruminant animals.

Contents
Theory

1. Digestive physiology, digestion and absorption; Factors affecting digestion
2. Grass and Legume Forage Species;Corn Silage Quality –
3. Dry Matter Intake; Fiber Digestion; Carbohydrate (NDF and NSC) Nutrition; Forage Analysis: Chemical Composition, Digestibility, Fermentation Analysis; Fat Digestion and Metabolism;Energy Metabolism
4. Protein Digestion in the GI Tract; Protein and Amino Acid Metabolism;Vitamin Nutrition - Mineral Nutrition; Calf and Heifer Nutrition; Dry and Transition Cows; Herd Evaluation Resources
5. Nutritional requirements of different classes of dairy animals; Feeding systems, feeding on complete feed, fodder plus supplementation, grazing plus supplementation, silage, haylage and hay; Feed formulation for calves, heifers, dry, pregnant and lactating cows
6. Nutritional disorders and deficiency diseases; Nutritional management of breeding bulls
7. Feeding of high yielding cows; bypass proteins, lipids and feeding frequency
8. Feed additives and feed supplements; Efficient usage of urea and other NPN sources in dairy feeding

Practical

1. Practical nutrition for lactating dairy cows;Digestion trials, measurement of digestion kinetics;Digestibility through indicator methods; Computerized feed formulation for different classes of animals; Hay and silage preparation

Recommended Texts

1. Ensminger, M.E., Old field, J.E. & Heinemann, W.W. (1990). *Feed and Nutrition Digest.* The Ensminger Publishing Company, Clavis, California 93612, USA.
2. Etgen, W.M. & Reaves, P.M.. (1992). *Dairy Cattle Feeding and Management*. John Wiley & Sons. USA.

Suggested Readings

1. McDonald, P., Edwards, A.R. , Greenhalgh, J.F.D. & Morgan, C.A. (2004). *Animal Nutrition* 7th Ed. Pearso Education Pvt. Ltd. Singapore.
2. NRC. (2005). *Nutrient Requirement of Goat, Angora, Dairy & Meat Goat in Temperate and Tropical Countries*. National Academy Press Washington USA.

The End

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