# ANIMAL NUTRITION

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*Compulsory for Master’s programme; **Compulsory for Doctoral programme*
ANIMAL NUTRITION

Course Contents

ANN 601 ANIMAL NUTRITION – ENERGY AND PROTEIN 3+0 SEM - I

Objective
Familiarization with fundamental concepts of energy and proteins, metabolism of carbohydrate, fat and protein and their efficiency of utilization. Requirement of carbohydrates, fat and proteins for various physiological functions.

Theory
UNIT-I: Basic terminology and classification of carbohydrates, fats and proteins. Fundamental concepts of Digestion and metabolism of Carbohydrate Fat and Protein in different species of animals. Gluconeogenesis, Recent advances in glucogenic precursors on acetate utilization. NPN metabolism, urea fermentation potential and metabolizable protein. Amino acids imbalance, antagonism and toxicity.
UNIT-III: Rumen degradable Protein (RDP), and rumen undegradable protein (UDP) and Kinetics. Energetics of protein synthesis and turn over. Quantification of microbial protein synthesis. Protein quality determination in monogastrics and utility.

Suggested Readings

ANN 602 ANIMAL NUTRITION – MINERALS, VITAMINS AND FEED ADDITIVES 3+1 SEM - II

Objective

Theory
Practical

Suggested Readings
Underwood EJ & Shuttle 1999. The Mineral Nutrition of Livestock. 3rd Ed. CABI.

ANN 603 FEED TECHNOLOGY 1+1 SEM - II

Objective
Introduction to the subject, formula feed manufacturing and different operations involved. Layout, designing, operation and management of feed mill.

Theory
UNIT-I: Importance of feed technology in relation to animal productivity. The integrated biological, chemical and physical basis for evaluating the inherent nutritional quality of feed ingredients and feeds. Familiarization of various feed mill equipments, layout and operations. Problems of feed manufacturing units and control measures. Quarantine measures.
UNIT-II: Introduction to the formula feed manufacturing including principles of material handling, grinding, mixing, pelleting and other major processing operations. Crumbling, Flaking, Popping, Extrusion. Principles of instrumentation and analysis, with emphasis on application to quality control and research in the feed industry.

Practical
Identification of feed ingredients and their specifications, as well as compound feed for different categories of livestock and poultry. Feed microscopy. Formulating premixes. Introduction to Pulverisers, pelletisers, complete feed blocks equipments Plant layout and design of different capacity of feed mills, problems related to feasibility, records keeping in different sections of feed mill. Experiential learning at the feed plant for preparing feed, urea molasses mineral blocks, mineral mixture.

Suggested Readings
Gohl BO. 1985. Tropical Feeds. FAO.
Objective
To acquaint with inherent nutritional quality of feed ingredients and feeds. Evaluation of feeds and fodders and feed preservation techniques. Procurement and storage of feed ingredients. Losses during storage and its control.

Theory
UNIT-I: Principles of feed and fodder processing and preservation techniques, their merits and demerits. Procurement, planning and purchase procedures; traditional and modern farm level storage structures. Feed storage and godown management, estimation of storage capacity and stack plan.
UNIT-II: Evaluation of processed and preserved feeds and forages. Role of moisture, temperature and relative humidity during storage of feedstuffs and their effect on biotic factors. Handling and storage of liquid feed ingredients. Physical and chemical changes in feeds during storage; storage losses; insect pests and rodents in feed stores and their control; Role of fungi, tolerance limits and measures to check them in stored products.
UNIT-III: Factors affecting the quality of feed and feedstuffs on preservation. Microbiological evaluation of processed and preserved feeds. Effect of preservation on nutritional value of feed. Properties and mode of action of pesticides and fumigants; principles of good sanitation and hygiene of godowns.

Practical
Laboratory evaluation of preserved and processed feed and forages. Physical properties of feeds and feedstuffs; identification of insect-pests and fungi in stored products; techniques for detection of hidden infestation in grains; quality control and inspection of stored feed materials; moisture equilibrium determination and estimation of chemical changes including alcoholic acidity, rancidity and uric acid in feeds during storage. Weende proximate analysis, Van Soest fibre fractionation, Enzymatic evaluation, Pro rata deduction (Feed laws), urea, FFA, peroxide value, adulterants, and heavy metal.

Suggested Readings

Objective
Requirement of nutrients for different physiological functions in various ruminant species. Latest concepts of feeding the nutrients for maximising production.

Theory
UNIT-I: Nutrients and their metabolism with special reference to milk, meat and wool production.
UNIT-II: Feeding standards, their history, comparative appraisal and limitations. Classification of feedstuffs. Nutrient requirements for calves, heifers, dry, pregnant and lactating cows, buffaloes, sheep and goat.
UNIT-IV: Concept of complete feed. Limiting nutrients and strategic feeding of high yielding
ruminants. Concept of by-pass nutrients and their impact on production, reproduction and immune status. Importance of CLA, omega fatty acids, Scope for value addition in milk. Different systems of feeding buffalo for beef production. Feeding during natural calamities, feeding in various agro-climatic zones of India.

**Practical**


**Suggested Readings**


**ANN 606**

**NON-RUMINANT NUTRITION**

**Objective**

Requirement of nutrients and feeding of various non-ruminants species for efficient quality production.

**Theory**

UNIT-I: Nutrients, their metabolism and requirements for poultry and swine during different stages of growth and production. Limiting iminoacids-lysine and methionine.
UNIT-II: Feeding systems and feed additives, feed formulations for different purposes including least cost rations.
UNIT-IV: Nutritional factors affecting quality of the products. Hind gut fermentation and its importance, Nutrient requirements of rabbits and equines, Nutritional manipulation for producing value added egg, meat / pork.

**Practical**

Design and planning for poultry and swine feeding experiments, formulation and compounding of general and least cost rations, determination of nutritive value of poultry and swine feeds by balance experiments, evaluation of protein quality, Visit to poultry and piggery units, feed and fodder stores, Use of software in least cost feed formulations.

**Suggested Readings**


**ANN 607**

**NUTRITION OF COMPANION, LABORATORY, WILD AND ZOO ANIMALS**

**Objective**

Preparation, storage and evaluation of feeds and feeding standards of companion/laboratory/wild and zoo animals.

**Theory**

UNIT-I: Feed Habbits, food Patterns, digestive structure and functions companion, laboratory, wild and zoo animals. Natural dietary habits. Nutritional requirements of various species of animals.
UNIT-II: Feeding standards and feeding habits of companion / laboratory animals. Importance of colostrum and feeding of neonates and growing animals. Feeding and care of nursing mothers. Feeding of sick and old animals. Post Surgical nutrition.
UNIT-IV: Composition, presentation, sterilization, palatability, assessment and storage of companion/laboratory animal diets. Companion food tables and their nutritional assessment. Mistakes and misleading information on companion food labels and labeling.


**Practical**

Formulation and preparation of hygienic, balanced diets and feeding for companion/laboratory animals. Characteristics of ration formulation and feeding schedules wild and zoo animals. Feeding schedules for sick and orphan wild / zoo animals. Artificial and emerging feeding. General feeding habits and different feed constituents of wild and captive animals. Research methodology of companion/laboratory animals. Processing and storage of companion/laboratory diets. Visit to Zoological parks and wildlife sanctuary.

**Suggested Readings**


**ANN 608**

**RESEARCH TECHNIQUES IN ANIMAL NUTRITION**

**Objective**

Planning and designing of experiments, use of various techniques in estimating chemical and bio-chemical constituents in feeds, fodders, blood, milk, rumen liquor, meat, wool etc.

**Theory**

UNIT-I: Principles of animal experimentation. Specialized feed compounding. Introduction and principle of GLC, HPLC, AAS, tracer technique, flame photometer, NIR, SF6, amino acid analyzer.

UNIT-II: Importance and principle of various techniques in estimating chemical and biochemical constituents and toxic principles in feeds, fodders. Importance, principles and procedures for estimating chemical and biochemical constituents in blood, milk, rumen liquor, meat, wool etc.

**Practical**


**Suggested Readings**


**ANN 609**

**NON-CONVENTIONAL FEEDSTUFFS AND TOXIC CONSTITUENTS/ANTIMETABOLITES IN ANIMAL FEEDSTUFF**

**Objective**

To understand the importance of alternate feeds and their use in augmenting profit in livestock farm. Different toxins present in feed stuffs, their properties and detoxification techniques.

**Theory**
UNIT-I: Present and future feed requirements and current availability for livestock and poultry. Use of non-traditional feeds – By-products of agricultural, industrial, food processing units and forest by-products. Evaluation by chemical and biological methods. Formulation of economical rations. Level of inclusion of various non conventional feeds in livestock ration.

UNIT-II: Classification of toxic principles in animal feedstuffs. Chemico-physical properties of various toxins. Effect of toxins on biological system and nutrients utilization in different species of livestock. Detoxification of toxin principles by various physical, chemical and biological techniques. Insecticide and pesticide residue detection.

Practical
Estimation of various protease inhibitors; tannins; and mycotoxins in various feeds and feedstuffs. Nitrates, HCN, oxalates, insecticide and pesticide residues, saponins, Gossypol, mimosine, heavy metals.

Suggested Readings

ANN 701 MODERN CONCEPTS OF FEEDING RUMINANTS AND FORAGE UTILIZATION 3+0 SEM - I

Objective
To impart knowledge of modern concepts in nutrient requirement and feeding and enhanced utilization in ruminant and recent development in analysis of forages.

Theory
UNIT-I: Developments in ruminant digestive physiology – Energy protein requirement and measurement – Requirements of other nutrients. Importance of energy and protein quantity and quality Feed input and milk output relationship.
UNIT-IV: Seminars on current topics of special interest.

Suggested Readings
Selected articles from journals.

ANN 702 MODERN CONCEPTS OF FEEDING MONOGASTRIC ANIMALS 2+0 SEM - I

Objective
To impart knowledge on modern concepts in nutrient requirement and feeding of monogastric livestock.

Theory
UNIT-II: Developments in digestive physiology of swine – equines – Measurement of protein and energy requirements – Influence of processing of feeds and fodders in monogastric animal nutrition.

**Suggested Readings**

Selected articles from journals.

**ANN 703  NUTRITION AND RUMEN FERMENTATION  1+1  SEM - II**

**Objective**
To impart knowledge on nutrient requirements for neonatal and post natal development of livestock, recent concepts of rumen fermentation and its manipulation.

**Theory**

**Practical**
Microbial and protozoal count, Determination TVFA by chromatography. Estimation of ammonia in rumen liquor – study on protection of protein in relation to degradability, Rumen fermentation products – Artificial rumen techniques. Rumen enzyme assay

**Suggested Readings**
Selected articles from journals.

**ANN 704  ADVANCES IN MICRONUTRIENTS  1+0  SEM - II**

**Objective**
To impart knowledge on nutrient requirements for neonatal and post natal development of livestock, recent concepts of rumen fermentation and its manipulation.

**Theory**
UNIT-II: Developments in vitamin and mineral requirements for growth, reproduction and lactation – Identification and correction of deficiencies and toxicities of minerals in farm animals.

**Suggested Readings**

Selected articles from journals.

**ANN 705  ADVANCED TECHNIQUES IN NUTRITION  1+2  SEM - I**

**AND RESEARCH**
Objective
To impart knowledge on use of advanced analytical techniques in nutrition research.
Theory
UNIT-II: Faecal innoculum as alternative to rumen liquor in in vitro studies – Degradability of feeds by various techniques – rates of VFA and microbial production.

Practical
Estimation of major, minor and toxic minerals by atomic absorption spectrophotometer, Estimation of mycotoxin by HPLC, Estimation of oxalate, nitrates, tannin and mimosine, VFA fractionation by GC. SF6 Technique, amino acid analyzer, NIR, HPLC, Purine derivatives, milk fat and FA estimation.

Suggested Readings
Selected articles from journals.

ANN 706 ADVANCES IN FEED TECHNOLOGY 1+1 SEM - II
Objective
To impart knowledge on modern feed processing methods and automated feed plant layout.

Theory

Practical
Feed microscopy tests for certain adulterants and anti nutritional factors, Feed plant design– processing of roughages – feed plant sanitation, Wild seed identification – qualitative tests for rancidity, minerals and adulterants, Visit to commercial feed plant.

Suggested Readings
Selected articles from journals.

ANN 707 CLINICAL NUTRITION 1+1 SEM - I
Objective
Impact of nutrition on health, immunity, digestive/metabolic disorders, reproductive performance, bacterial and parasitic infestations, organic toxins and stress nutrition, feeding management of sick animals.

Theory

Practical
Determination of blood glucose, blood urea nitrogen, SGOT SGPT, total protein, cholesterol and ketone bodies, Metabolic profile tests.

Suggested Readings
Selected articles from journals.

ANN 708 NUTRIENT AND DRUG INTERACTION 2+0 SEM - II
Objective
To impart knowledge on the effects of drugs on nutrient utilization.
Theory
Suggested Readings
Selected articles from journals.

ANN 709 NEW FEED RESOURCES AND TOXICANTS 2+0 SEM - II IN ANIMAL FEEDING

Objective
To impart knowledge on newer feed resources and their value in animal feeding and various toxic substances prevalent in feeds and fodders.

Theory
UNIT-II: Processing to enhance feed utilization and availability. Possible health hazards due to waste utilization-chemical and nutritional changes in waste product due to processing. Quality standard and their acceptance.
Suggested Readings
Selected articles from journals.
ANIMAL NUTRITION

List of Journals

- Animal Feed Science and Technology
- Animal Nutrition and Feed Technology
- Animal Research
- Animal Science Journal
- Archives of Animal Nutrition
- Australian Journal of Animal Sciences
- British Journal of Nutrition
- British Poultry Science
- Canadian Journal of Animal Sciences
- Feed Industry Review
- Feed International
- Feed Management
- Feed Stuffs
- Feed Trends
- Grass and Forage Science
- Indian Journal of Animal Nutrition
- Indian Journal of Animal Science
- Indian Journal of Dairy Science
- Indian Journal of Poultry Sciences
- International Journal of Sheep and Wool Science
- Italian Journal of Animal Science
- Journal of Animal and Feed Sciences
- Journal of Animal Nutrition
- Journal of Animal Physiology and Animal Nutrition
- Journal of Food Science and Technology
- Livestock Research for Rural Development
- Malaysian Journal of Nutrition
- Nutrition Journal
- Pakistan Journal of Nutrition
- Small Ruminant Research

e- Resources

- http://www-biol.paisley.ac.uk/kinetics/contents.html
- http://www.das.psu.edu/dairynutrition/
- http://www.uky.edu/~dhild/biochem/supp.html
- http://vanat.cvm.umn.edu/run/plate7.html
- http://www.ales2.ualberta.ca/afns/drtc/
- http://www.cfmaofindia.org/
- http://www.nianp.res.in/
- http://www.nutrisocietyindia.com/
- http://www.fao.org
- http://www.codexalimentarius.net/web/index_en.jsp
- http://www.aphca.org/

**Suggested Broad Topics for Masters and Doctoral Research**

- Utilization of non conventional feed/ fodder resources
- Evolving / Assessing feed additives / supplements
- Manipulation of rumen fermentation to enhance productivity
- Feed processing for efficient utilization
- Improving palatability, digestibility of companion food
- Preservation and storage of feed / fodder
- Developing functional foods though dietary manipulation
- Neonatal growth stimulants
- Developing sick diet / Geriatric diet to companion/ domestic/ Wild animals
- Problem solving approach like formulating area specific mineral mixture
- Developing residue free animal produce through dietary management
- Addressing global issues /pollutants through feeding manipulation
## ANIMAL PRODUCTION PHYSIOLOGY

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