Livestock Production Technology & Products Management

ANIMAL NUTRITION

Course Structure - at a Glance

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ANN 601: ANIMAL NUTRITION - ENERGY AND PROTEIN 3+0

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 II

UNIT III
Rumen degradable Protein (RDP), and rumen undegradable protein (UDN) and Kinetics. Energetics of protein synthesis and turn over. Quantification of microbial protein synthesis. Protein quality determination in monogastrics and utility.

UNIT IV

Suggested Readings

ANN 602: ANIMAL NUTRITION - MINERALS, VITAMINS AND FEED ADDITIVES 3+1

**Objective**: Role, requirement, functions, deficiency and toxic effects of vitamins, essential, probably essential and toxic minerals.

**Theory**

UNIT I
Definition, history, classification, chemistry, functions, deficiencies and excesses, requirements and sources of water soluble and fat-soluble vitamins.

UNIT II

UNIT III
Relationship of vitamins with other nutrients. Critical vitamins for ruminants and non-ruminants. Feed additives including probiotics, Prebiotics, Symbiotics and feed enzymes. Research techniques in nutrition.

**Practical**

**Suggested Readings**
ANN 603: FEED TECHNOLOGY  

**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.

**UNIT III**

The formulation of concentrate mixtures, premixes and rations using computer. Automated feed mill. Personal management in feed plants, laws and regulation of feed manufacturing industry. Codex alimentarius, HACCP. Organizational charts for small, medium and large feed plants, labour standard, planning and production programme, handling of plant equipment. Merits and demerits of automated feed plant

**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**


ANN 604: FEED CONSERVATION, STORAGE AND QUALITY CONTROL  

**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.

UNIT IV


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


ANN 605: RUMINANT NUTRITION 2+1

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 III

Introduction to rumen microflora and fauna. Development of rumen. Role of milk replacers and calf starters.

UNIT IV

Feed formulation of large and small ruminants for different physiological stages. 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

Design and planning of feeding experiments. Identification of feed and fodder on the basis of its composition. Artificial rumen technique, Methods for evaluation of feedstuffs- in vitro gas, in sacco digestion kinetics. Determination of nutritive value of feeds and fodders by metabolism trial in dairy cattle, determination of nutritive value of pastures by the use of range techniques, study of rumen metabolic profile. Preparation of Bypass Nutrients Identification of rumen microbes and rumen studies.
ANN 606: NON-RUMINANT NUTRITION 1+1

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 III


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. Basic principles governing the least cost formulation software’s.

Suggested Readings


ANN 607: NUTRITION OF COMPANION, LABORATORY, WILD AND ZOO ANIMALS 2+1

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

Theory

UNIT I

Feed Habits, 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 III

Ration formulation for captive animals. Artificial feeding and feeding during emergency. Nutritive characteristics of forages for wild animals. Adequacy of forage plants for wild and zoo animals. Diets used in captivity. Raising orphans. Nutritional melodies. Nutrition of semi wild and semi domestic animals like mithun and yak under special topography

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.
UNIT V

Nutraceuticals in companion/laboratory foods and animal foods. Nutritional deficiency diseases. Geriatric nutrition - corrective measures

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


Givens DI, Owel E, Aford REF & Omed HM. 2000. Forage Evaluation in Ruminant Nutrition. CABI.


ANN 608: RESEARCH TECHNIQUES IN ANIMAL NUTRITION 1+3

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


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

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 II


UNIT III

Use of conserved forages in ruminant feeding. Chemical composition of common and newer forage - Factors affecting nutritive value of commonly available grasses, pastures, silage, hay and crop residues, voluntary intake of fodder at different stages of growth.


Seminars on current topics of special interest.

Suggested Readings: Selected articles from journals
ANN 702: MODERN CONCEPTS OF FEEDING MONOGASTRIC ANIMALS

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

Theory

UNIT I
Nutritional factors affecting egg quality and hatchability in poultry. Feeding for designer eggs. Role of essential fatty acids, amino acids imbalance, toxicity and interactions in monogastrics

UNIT II
Developments in digestive physiology of swine - equines - Measurement of protein and energy requirements - Influence of processing of feeds and fodders in mono-gastric animal nutrition.

UNIT III
Modern concepts of amino acid nutrition at various physiological status - Role of vitamins and minerals in health and disease. Advances in new generation feeds and feed additives.

Suggested Readings

ANN 703: NUTRITION AND RUMEN FERMENTATION

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 I
Nutrient requirements for fertility and gestation, prenatal growth and foetal nutrition. Post-natal feeding, growth and developments - Body composition at prenatal and postnatal stages, abnormalities due to malnutrition.

UNIT II
Rumen microflora and microfauna - considerations and limitations in relation to ruminant feeding practices. Manipulation of rumen fermentation - physical, chemical and biological means - Role of sulphur and phosphorus in rumen fermentation - Modeling ruminant digestion and metabolism - principles.

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

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 I
Developments in the study of major, minor and toxic minerals in animals - animal - soil - plant interrelationship - concepts in absorption and transport of micronutrients - Kinetics and metabolism physiological and biochemical interactions among nutrients - interrelationship of minerals and vitamins in relation to metabolism and requirements - mineral toxicities in relation to livestock feeding.

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.

UNIT III
Bio-availability of macro and micro nutrients - factors affecting the bio-availability of minerals - bio-marker concept for mineral requirement for correction of deficiencies and toxicity of minerals.

**Suggested Readings**


### ANN 705: ADVANCED TECHNIQUES IN NUTRITION AND RESEARCH  1+2

**Objective:** To impart knowledge on use of advanced analytical techniques in nutrition research

**Theory**

**UNIT I**

Developments in analysis of nutrients in feeds. Estimation of toxins and mycotoxins - Application of atomic absorption spectrophotometer, HPLC - Enzymatic methods of feed analysis - Isotopes in nutrition research - Feed microscopy - Analytical aspect of feeds and fodders using N.I.R.

Faecal inoculum 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

**Objective:** To impart knowledge on modern feed processing methods and automated feed plant layout

**Theory**

**UNIT I**

Feed and fodder processing - Particle size reduction - bulk density - processing of grains and oil seeds - processing of roughages - feed plant layout and design - feed plant management - storage of feeds.

**UNIT II**

Non conventional feed resources - Formulaion of concentrates, premixes and rations - improvement of nutritive value of poor quality roughages - liquid feed supplements. Solid state fermentation (SSF) technology.

**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

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

UNIT I

Nutritional factors responsible for disorders. Metabolic disorders and production diseases in farm animals. Prevention of metabolic disorders - recommended dietary regimen.


UNIT III

Stress nutrition and post surgical nutrition. Nutritional manipulation and feeding of sick animals. Pesticides residues in feeds and fodders and their impact on animal health, reproduction and production.

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

Objective: To impart knowledge on the effects of drugs on nutrient utilisation

Theory

UNIT I

Effects of drugs on digestion and absorption of nutrients - Drugs and intestinal microbial interaction - Effect of drugs and antibiotics as feed additives. Physiological effects - Use and abuse.

UNIT II


Suggested Readings: Selected articles from journals.

ANN 709: NEW FEED RESOURCES AND TOXICANTS IN ANIMAL FEEDING 2+0

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 I

Demand and availability of feed - formulation of database in computer -strategy in food animal production - agricultural by-products - Agroindustrial by-products, Farm waste, crop residues, organic wastes of animal origin. Slaughter house waste, industrial waste and their feeding value in animals.

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.

UNIT III

Naturally occurring toxicants - Toxicants of plants and non-microbial origin. Naturally occurring alkaloids, mycotoxins and their toxicity - Acquired toxicants, pesticides, weedicides and heavy metals.

UNIT IV

Effect of toxins on rumen fermentation and nutrient utilization. Methods of detoxification. Food and feed contaminants - their impact on animal performance

Suggested Readings: Selected articles from journals.