

**NEW AND RESTRUCTURED
POST-GRADUATE CURRICULA & SYLLABI**

**Livestock Production Technology
&
Products Management**

Animal Genetics & Breeding

Animal Nutrition

Livestock Production and Management

Livestock Products Technology

Poultry Science



**Education Division
Indian Council of Agricultural Research
New Delhi**

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EXECUTIVE SUMMARY

I. The New Approach

The proposed course curricula and syllabi in animal science disciplines have been prepared in the light of PG programs in vogue at different veterinary colleges in India and contemporary developments in animal sciences. The guiding principle of the proposed new approach is to impart comprehensive and practical knowledge by covering all important aspects of the subject area of study at Master's level. It is proposed that each M.Sc./MVSc student should register for all the courses offered by the major department, instead of opting for courses of 1 or 2 sub-disciplines only.

II. Credit Requirements

- Common academic regulations for post graduate education in SAUs, DUs and CAU as proposed in table 2 will be followed with slight adjustments to accommodate specific and special needs to build up and enhance the knowledge based competence of the animal science students as given below.
- The total course work of 40 credit hours has been proposed at M.Sc./M.V.Sc. level instead of minimum requirement 35 credit hours (Table 1), keeping the research credit hours (20) unchanged. Break up of the course work: Major subject (including 1 credit seminar) - 29 credits, minor subject (specified in table 1) and supporting subjects (as per requirement) together -11 credits.
- At Ph.D. level, it is proposed to keep course credit hours (30) and research credit hours (45) unchanged. However, break up of the course work: Major subject (including 2 credit seminars) - 19 credits, minor subject (specified in table 1) and supporting subjects (as per requirement) together-11 credits.
- Out of 11 credit hours for minor and supporting subjects, courses with a minimum of 6 credits should be taken from minor subject and course(s) with a minimum of 3 credit hours from supporting subject(s) should be taken. Thus students will have the option to register courses of 6 to 8 credit hours in minor subject and of 3 to 5 credits in supporting subject.

- The credit hours for minor and supporting subjects both at Master's and Doctoral level have been reduced to compensate partially for the increased credit load of courses of major subject.
- Besides, four general non-credit courses namely, Library and Information Services (0+1), Technical Writing and Communication Skills (0+1), Intellectual Property and its Management (1+0) and Disaster Management (1+0) are mandatory at Master's level, and at Doctoral level, if not studied already.
- The undergraduate courses for B.V.Sc. & A.H. students, formulated and implemented uniformly in all veterinary colleges of India under statutory provisions of Veterinary Council of India, are up to 500 series. To avoid overlapping and confusion generated thereof, the numbering of courses is also revised i.e., 600 series for M.Sc./MVSc and 700 for Ph.D. programme.

Based upon the key issues that are assuming priority day by day, the areas which need to be strengthened in various disciplines, are outlined hereunder.

Animal Genetics and Breeding

Molecular techniques in animal breeding, biometrical techniques in animal breeding, conservation of animal genetic resources and bio-informatics in animal genetics and breeding.

Animal Nutrition

New concepts in feed technology, feed analysis and quality control, clinical animal nutrition, nutrition of companion and laboratory animals, nutrition of wild and captive animals, toxic constituents in animal feed stuffs, modern concepts in feeding of ruminants, monogastrics, rumen fermentation, micronutrients and nutrient-drug interaction.

Livestock Products Technology

Abattoir and slaughter technology, fresh and processed meat technology, animal by products processing, poultry other than chickens and broilers such as turkeys, ducks, geese, quails, emu and ostriches.

Livestock Production and Management

Shelter designs and engineering, climatology in relation to animal production, poultry farm and hatchery management, integrated livestock production systems, acts and regulations

relating to animal welfare, livestock business management, management of rabbits and intensive rearing of goats, sheep, swine and buffaloes for meat and milk.

Poultry Science

Commercial layer and broiler production, breeder flock and hatchery management, bio-security of flock management, poultry economics, micro-nutrients and amino acids in poultry nutrition, commercial aspects of marketing and integration.

Regarding certain specific suggestions made during the presentation of the draft report of this BSMA Committee, the following response by way of clarification may be worthwhile mentioning:

Animal Physiology is distinct from Veterinary Physiology deals with physiological aspects relating to production, such as body maintenance, growth, lactation and various other productive and reproductive traits. While the governing basic features of Physiology remain the same in both the streams, in Animal Physiology, the relationship with nutrition, breeding, management, climate and environment are given special emphasis.

Regarding the admission of B.Sc Agriculture and dairy science graduates to PG programmes in LPM, it can be considered by prescribing supplementary/pre-requisite courses, if need be, as per admission relations and concerned Advisory Committee Recommendations.

**BSMA Committee on Livestock Production Technology & Production
Management**

(Animal Sc./Animal Husb./Animal Bre./Animal Nutrition & AFT/LPM/APT/Poultry
Sciences)

(Constituted by ICAR vide Office order No. F. No. 13 (1)/2007- EQR dated January 14, 2008)

Name	Address	Specialization
Dr. N. Balaraman Former Vice- Chancellor Convener	Tamil Nadu Univ. of Vety. & Animal Science, Chennai	Animal Nutrition
Dr. B. K. Joshi Director	NBAGR, Karnal	Animal Breeding
Dr. S. K. Jindal Principal Scientist	Animal Physiology, CIRG, Makhdoom, Farh, Mathura (UP)	Animal Physiology
Dr. B. T. Deshmukh Prof.& Head	Deptt. of Physiology & Biochemistry, Bombay Vety. College, Parel, Bombay	Animal Physiology
Dr. Arjava Sharma Head	Division of Animal Gentices & Breeding, IVRI, Izatnagar, Bareilly	Animal Breeding
Dr. V. K. Tanwar Professor	Veterinary College, GBPUA & T, Pantnagar	LPT
Dr. C. L. Marwah Professor	Dept. of LPM, COVS, CSKHPAU, Palampur	LPM
Dr. R .S. Yadav Professor Member Secretary	Dept. of LPM, College of Animal Science, CCS HAU Hisar	LPM

PREAMBLE

Livestock sector has gained prominence during the past three decades owing to its impressive growth and increasing GDP contribution within the agricultural sector. Livestock rearing practices have dramatically changed in recent years from subsistence to commercial, subsidiary to main-occupational and unorganized to intensively organized systems. These achievements have taken place in spite of the limited priority and monetary allocations to this sector and the poor resources of the majority of the farmers who have contributed to this phenomenal transition. The high quality man power generated through the educational institutions dealing with veterinary and animal sciences has been mainly instrumental in fulfilling the technological backstopping needed at the field level, through scientific research and technology development. The farming community and the industry adopted latest innovations in production, processing, health and management, resulting in production and productivity enhancement and increased per capita availability of livestock products.

Today, India leads the world in milk production with around 100 million tonnes per annum. Over seventy per cent of the milk produced in India is contributed by semi-medium, small, marginal and landless farmers. Another significant feature of milk production is that over 56 per cent of it is derived from the buffalo, which is an animal species of pride to this country. Poultry sector has set the trend for other sub-sectors of livestock rearing by its intensive commercialization, high productivity level and technology adoption of a high order. Concerns of food and nutritional security are being adequately addressed through inclusion of food products of animal origin in the human diet, particularly the vulnerable sections of the society such as growing children, adolescents, pregnant and nursing mothers, senior citizens and convalescing patients.

Livestock sector is not only a sustainable livelihood option, but also an appropriate medium of socio-economic growth through educational empowerment, employment and entrepreneurship development and gender equity for millions of people in the country. Value addition at the farm level brings additional income to the producer and saves food products of animal origin from deterioration and wastage. Environmental protection through proper shelters, drainage, waste disposal and recycling has become all the more important when our country enters into the era of commercial and intensive production. There are several areas of untapped resources with large scope for development. In the meat sector, the sheep, goats and

swine need to be paid more attention. Buffalo meat production is gaining popularity with increased prospects of export. Emerging dimensions relating to phyto-sanitary monitoring and quality assurance are becoming immensely relevant at national and global levels.

It is imperative that, in tune with the change of times and modern needs, the large scale developments in science and technology in the field of livestock production and processing are appropriately incorporated into the proposed revised course curricula in respect of postgraduate and doctoral programmes. This task has been undertaken by the Broad Subject Matter Area (BSMA) Committee. The subject matter area has been identified as “Livestock Production Technology and Products Management”. This exercise has been the outcome of the initiative provided by the Education Division of Indian Council of Agricultural Research, which has constituted the 18 BSMA Committees to cover the entire area of agricultural sciences. The BSMA Committee on Livestock Production Technology and Products Management seriously deliberated upon the issues concerning animal sciecn education in general, and livestock production technology and products management in particular. The curricula and syllabi of all the seven disciplines, viz., Animal Breeding, Animal Nutrition, Animal Physiology, Animal Products Technology, Livestock Production and Management, Meat Science and Poultry Science were discussed at length in the meetings and workshop convened by the BSMA Committee.

The key issues, which need to be specially addressed while contemplating on the revision of course curricula at PG and doctoral levels are: supply of high quality germplasm to farming community, compounded feed supply to intensive livestock production units, adoption of concepts such as total mixed rations, complete feeds, strategic bio-available micro-nutrient supplements, land use for intensive green fodder production, shelter designs for in-house livestock rearing amenable to automation and mechanization, clean milk production to be taken up as a national mission, phyto-sanitary measures for traceability and quality assurance of products of animal origin, onward linkages for processing and marketing of meat, particularly from small ruminants, swine and buffalo, cold chain infrastructure for meat, milk and eggs, entrepreneurship building and economic analysis of livestock production including pricing, insurance, credit, technological backstopping and assessment of economic losses associated with inadequate prioritization of the livestock enterprise.

The implementation of the new and restructured post graduate course curricula is expected to build knowledge and skill portfolio of the students so as to enhance their employability and marketability as multi-service providers with practical skills and comprehensive knowledge of the entire subject area after masters. The doctorates should, in turn, prove as specialists, in the field of their specialization. The valuable inputs received from the stake holders viz. eminent academicians, scientists, extension workers, pharmaceutical/ dairy industry, leading veterinary practitioners, state animal husbandry department etc. have immensely helped in preparation of this document.

The BSMA Committee wishes to place on record the help rendered by Dr. Lalitha John, Dean, Madras Veterinary College, Faculty and Staff Members of TANUVAS especially Dr. T. Sivakumar and Dr. J. John Kirubaharan for coordinating the various BSMA committee meetings and for their active participation, unstinted cooperation and assistance. The help rendered by National Core Group under the Chairmanship of Dr. J.C. Katyal, Vice-Chancellor, CCS Haryana Agricultural University, Hisar for providing guidance and regulations and format is greatly acknowledged. The committee is also indebted to Dr. S.P. Tiwari, DDG (Education) and Dr. R.K. Mittal, ADG (EQR), ICAR for providing all administrative assistance. The critical inputs provided by Dr. Dharmeshwar Das (Member, NCG), Dr. B.K. Joshi, Dr. Arjava Sharma, Dr. N. Balaraman, Dr. V. Balakrishnan, Dr. B.T. Deshmukh, Dr. R.S. Yadav, Dr. T. Shivkumar, Dr. F.R. Sheriff, Dr. J.J. Robinson Abraham were helpful in designing this document. The basic document (1st draft) prepared by the faculty of Animal Sciences, CCS Haryana Agricultural University, Hisar, the efforts put in by the HAU faculty is highly appreciated.

ORGANIZATION OF COURSE CONTENTS & CREDIT REQUIREMENTS

Code Numbers

- All courses are divided into two series: 600-series courses pertain to Master's level, and 700-series to Doctoral level. A Ph. D. student must take a minimum of two 700 series courses, but may also take 600-series courses if not studied during Master's programme.
- Credit seminar for Master's level is designated by code no. 691, and the two seminars for Doctoral level are coded as 791 and 792, respectively.
- Similarly, 699 and 799 codes have been given for Master's research and Doctoral research, respectively.

Course Contents

The contents of each course have been organized into:

- Objective – to elucidate the basic purpose.
- Theory units – to facilitate uniform coverage of syllabus for paper setting.
- Suggested Readings – to recommend some standard books as reference material. This does not unequivocally exclude other such reference material that may be recommended according to the advancements and local requirements.
- A list of journals pertaining to the discipline is provided at the end which may be useful as study material for 600-series courses as well as research topics.
- E-Resources - for quick update on specific topics/events pertaining to the subject.
- Broad research topics provided at the end would facilitate the advisors for appropriate research directions to the PG students.

Minimum Credit Requirements

Subject	Master's programme	Doctoral programme
Major	28	17
Minor + Supporting (minimum 6 for minor & 3 for supporting)	11	11
Seminar	01	02
Research	20	45
Total Credits	60	75
Compulsory Non Credit Courses	See relevant section	

Major subject: The subject (department) in which the students takes admission

Minor subject: The subject closely related to students major subject. A suggested list of specified minor subjects is given below.

Supporting subject: The subject not related to the major subject. It could be any subject considered relevant for student's research work.

Non-Credit Compulsory Courses: Please see the relevant section for details. Six courses (PGS 501-PGS 506) are of general nature and are compulsory for Master's programme. Ph. D. students may be exempted from these courses if already studied during Master's degree.

Suggested list of specified minor subjects (departments)

Major Subjects	Minor Subjects
Animal Genetics and Breeding	Genetics, Animal Biotechnology, Statistics, Livestock Production and Management, Vety. Gynecology & Obstetrics, Animal Reproduction, Vety. Physiology, Vety. Biochemistry, Poultry Science, Animal Nutrition.
Animal Nutrition	Bio-chemistry, Veterinary Physiology, Livestock Production and Management, Animal Biotechnology, Livestock Product Technology, Poultry Science.
Livestock Production and Management	Animal Nutrition, Animal Genetics & Breeding, Livestock Products Technology and Veterinary and Animal Husbandry Extension
Livestock Products and Technology	Food Science and technology, Biochemistry, Microbiology, veterinary public health, Poultry science, Livestock Production and Management
Poultry Science	Animal Genetics & Breeding, Animal Nutrition, Livestock Product Technology, Livestock Production and Management.

Note: The choice of minor courses other than those listed above, may be allowed on the recommendations of advisory committee, if essentially required as per the research problem, with the concurrence of Head of the department and Dean post graduate studies.

ANIMAL GENETICS AND BREEDING
Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
AGB 601	ANIMAL CYTOGENETICS AND IMMUNOGENETICS	2+1
AGB 602	MOLECULAR GENETICS IN ANIMAL BREEDING	2+1
AGB 603	POPULATION AND QUANTITATIVE GENETICS IN ANIMAL BREEDING	2+1
AGB 604	SELECTION METHODS AND BREEDING SYSTEMS	3+1
AGB 605	BIOMETRICAL TECHNIQUES IN ANIMAL BREEDING	3+1
AGB 606	CONSERVATION OF ANIMAL GENETIC RESOURCES	2+0
AGB 607	CATTLE AND BUFFALO BREEDING	2+1
AGB 608	SMALL FARM ANIMAL BREEDING (SHEEP, GOAT, SWINE AND RABBIT)	2+0
AGB 609	POULTRY BREEDING	2+1
AGB 610	LABORATORY ANIMAL BREEDING	1+0
AGB 691	MASTER'S SEMINAR	1+0
AGB 699	MASTER'S RESEARCH	20
AGB 701	RECENT ADVANCES IN ANIMAL GENETICS	2+0
AGB 702	RECENT TRENDS IN ANIMAL BREEDING	2+0
AGB 703	ADVANCES IN BIOMETRICAL GENETICS	2+1
AGB 704	ADVANCES IN SELECTION METHODOLOGY	2+1
AGB 705	BIOINFORMATICS IN ANIMAL GENETICS AND BREEDING	2+0
AGB 706	ADVANCES IN MOLECULAR CYTOGENETICS	2+0
AGB 707	UTILISATION OF NON-ADDITIVE GENETIC VARIANCE IN FARM ANIMALS	2+1
AGB 791	DOCTORAL SEMINAR I	1+0
AGB 792	DOCTORAL SEMINAR II	1+0
AGB 799	DOCTORAL RESEARCH	45

ANIMAL GENETICS AND BREEDING

Course Contents

AGB 601 ANIMAL CYTOGENETICS AND IMMUNOGENETICS 2+1

Objective

To educate about basic principles of cytogenetics and immunogenetics and their applications in improving farm animals.

Theory

UNIT I

Development in animal cytogenetics and immunogenetics of farm animals. Immunoglobulins and their types: antigen-antibody interactions, Immune response, ELISA.

UNIT II

Major histocompatibility complex; genetics of biochemical variants and their applications; Ir-genes and concepts of disease resistance including major genes; hybridoma and its significance; concept of immuno-fertility, BoLA, BuLA, TLRs, Interleukins.

UNIT III

Chromatin structure of eukaryotes; chromosome number and morphology in farm animals banding and karyotyping; chromosomal and genetic syndromes, DNA packing in chromosomes, Z+B DNA, FISH chromosome painting and PRINS. RH Panel Mapping.

UNIT IV

Mutation and assays of mutagenesis; sister chromatid exchanges; recombinant DNA technique and its application in animal improvement programme.

Practical

Polymorphism of haemoglobulins, transferrins, enzymes/proteins; preparation of monovalent blood reagent-isoimmunization, titre testing and absorption of polyvalent serum; identification of bar bodies; in vitro and in vivo preparation of somatic metaphase chromosomes; screening of chromosomal abnormalities; microphotography and karyotyping; banding procedures for comparing the chromosomal complement, FISH and PRINS.

Suggested Readings

Hare WCD & Elizabeth L Singh 1999. *Cytogenetics in Animal Reproduction*. CABI.

Roitt I. 1997. *Essential Immunology*. Blackwell.

Stine GJ. 1989. *The New Human Genetics*. Wm C Brown Publ.

Summer AT & Chandley AC. 1993. *Chromosome Today*. Chapman & Hall.

AGB 602 MOLECULAR GENETICS IN ANIMAL BREEDING 2+1

Objective

To educate about molecular techniques to identify molecular markers as an aid to selection.

Theory

UNIT I

Basic concept: Genesis and importance of molecular techniques; Genome organization – physical and genetic map, current status of genome maps of livestock

UNIT II

Molecular markers and their application; RFLP, RAPD, Microsatellite/ Minisatellite markers, SNP marker, DNA fingerprinting

UNIT III

DNA sequencing, Genome sequencing, Genomic Library, Polymerase Chain Reaction (PCR), its types (PCR-RFLP, AS-PCR etc.) and applications; Transgenesis and methods of gene transfer

UNIT IV

Statistical techniques for analyzing molecular genetic data, Quantitative Trait Loci (QTL) mapping and its application in animal breeding, Genome scan, Candidate gene approach, Genomic selection, Marker Assisted Selection- basic concept

Practical

Extraction and purification of genomic DNA, Gel electrophoresis, Restriction enzyme digestion of DNA and analysis, PCR, PCR-RFLP, PCR-SSCP, Bioinformatics tool for DNA sequence analysis, Design of primer, Isolation of RNA, cDNA synthesis, Statistical methods for analyzing molecular genetic data.

Suggested Readings

Akano IE 1992. *DNA Technology*. IAP Academic Press.

Micklos DA, Fryer GA & Crotty DA. 2003. *DNA Science*. Cold Spring Harbour.

Setlow JK. 2006. *Genetic Engineering – Principles and Methods*. Springer.

AGB 603

POPULATION AND QUANTITATIVE GENETICS IN ANIMAL BREEDING

2+1

Objective

To study genetic structure of animal population and importance of genetic variation and covariation among traits.

Theory

UNIT I

Individual versus population. Genetic Structure of population. Factors affecting changes in gene and genotypic frequencies and their effect on genetic structure of animal populations. Approach to equilibrium under different situations: Viz: Single autosomal locus with two alleles, single sex-linked locus, two pairs of autosomal linked and unlinked loci;

UNIT II

Small population: random genetic drift, effective population size, pedigreed populations, regular and irregular inbreeding systems.

UNIT III

Quantitative genetics-gene effects, population mean and variance and its partitioning, biometric relations between relatives.

UNIT IV

Genetic and phenotypic parameters-their methods of estimation, uses, possible biases and precision. Scale effects and threshold traits.

Practical

Problems relating to gene and genotypic frequencies under different conditions. Estimation of inbreeding in regular and irregular systems. Estimation of effective population size. Computation of quantitative genetic effects. Estimation of variance components. Computation of heritability, repeatability, genetic, environmental and phenotypic correlations and their standard errors.

Suggested Readings

- Bulmer MG. 1980. *The Mathematical Theory of Quantitative Genetics*. Clarendon Press.
- Crow JF & Kimura M. 1970. *An Introduction to Population Genetics. Theory*. Harper & Row.
- Falconer DS & Mackay TFC 1996. *An Introduction to Quantitative Genetics*. Longman.
- Jain JP. 1982. *Statistical Techniques in Quantitative Genetics*. Tata McGraw-Hill.
- Pirchner F. 1981. *Population Genetics in Animal Breeding*. S. Chand.

AGB 604

SELECTION METHODS AND BREEDING SYSTEMS

3+1

Objective

To explain the methodology of selection and breeding systems for genetic improvement of livestock and poultry.

Theory

UNIT I

Type of selection and their genetic consequences. Response to selection and its prediction and improvement of response to selection.

UNIT II

Theoretical aspects of accuracy and efficiency of different base of selection. Prediction of breeding value using different criteria. Combined Selection. Correlated response to selection and efficiency of indirect selection.

UNIT III

Selection of several traits. Evaluation of short term and long term selection experiments viz: bidirectional selection and asymmetry of response, selection plateau and limit.

UNIT IV

Genetic aspects and consequences of various mating systems. Effects of mating systems on mean and variance. Application of various mating system in animal improvement. Selection for general and specific combining ability. Genetic polymorphism and its application in genetic improvement.

Practical

Estimation of breeding values from different sources of information. Prediction of direct and correlated response to different bases of selection. Computation of breeding values using different sources of information for female and male

selection. Computation of realized heritability and genetic correlation. Selection index: Computation, Accuracy and response in component traits. Estimation of heterosis for different types of crosses. Estimation of GCA and SCA

Suggested Readings

- Falconer DS & Mackay TFC. 1996. *An Introduction to Quantitative Genetics*. Longman.
- Jain JP. 1982. *Statistical Techniques in Quantitative Genetics*. Tata McGraw-Hill.
- Tomar SS 1996. *Text Book of Population Genetics*. Vol. I. *Qualitative Inheritance*; Vol. II. *Quantitative Inheritance*. Universal Publ.

AGB 605 BIOMETRICAL TECHNIQUES IN ANIMAL BREEDING 3+1

Objective

To educate about the various biometrical techniques for data analysis and their applications in animal breeding research.

Theory

UNIT I

Review of basic concepts in statistical inference and balanced experimental designs. Nature of structure of animal breeding data and sources of variation.

UNIT II

Introduction to matrix algebra, types of matrices and matrix operations. Determinants and their properties, methods of finding inverse of a matrix and their application

UNIT III

ANOVA, Regression and Correlations, Henderson's methods for estimation of variance components, Basic concepts of linear models, Least-squares analysis, maximum likelihood; Method of estimation; Generalized LS and weighted LS. Fisher's discriminant function and its application, D2 - Statistics in divergent analysis.

UNIT IV

Linear models in animal breeding, Methods of analysis of unbalanced animal breeding data. Adjustment of data. Data base management and use of software packages in animal breeding.

Practical

Matrix applications, determinant and inverse of matrices; Building of models for various types of data; Estimation of variance components; Least squares method for analysis of research data; Collection, compilation, coding, transformation and analysis of animal breeding data by using above biometrical techniques with computer application.

Suggested Readings

- Henderson CR. 1984. *Application of Linear Models in Animal Breeding*. Univ. of Guelph.
- Kaps M & Lamberson WR. 2004. *Biostatistics for Animal Science*. CABI.
- Mather K & Jinks JI. 1977. *Introduction to Biometrical Genetics*. Chapman & Hall.

Searle Sr. 1971. *Linear Models*. John Wiley & Sons.

Singh RK & Choudhary BD. 1977. *Biometrical Methods in Quantitative Genetic Analysis*. Kalyani.

AGB 606 CONSERVATION OF ANIMAL GENETIC RESOURCES 2+0

Objective

To educate about the concept of conservation of Animal Genetic Resources and their sustainable utilization.

Theory

UNIT I

Domestic Animal Diversity in India, its origin, history and utilization. Present status and flow of Animal Genetic Resources and its contribution to livelihood security. Methodology for genotypic characterization of livestock and poultry breeds through systematic surveys. Fodder availability; management of breed; physical, biochemical and performance traits and uniqueness of animals of a breed; social, cultural and economic aspects of their owners/communities rearing the breed.

UNIT II

Methodology for molecular genetic characterization, diversity analysis and relationship among the breeds. Concept of conservation, *In-situ* and *ex-situ* (*in-vivo* and *in-vitro*); models of conservation; prioritization of breeds for conservation. National and international strategies for conservation of Animal Genetic Resources.

UNIT III

Status, opportunities and challenges in conservation of AnGR. IPR issues pertaining to animal genetic resources/animal products or by-products. Registration of livestock breeds and protection of livestock owner's rights in India.

Suggested Readings

Lasley JF. 1987. *Genetics of Livestock Improvement*. 3rd Ed. IBH.

Nicholas FW. 1987. *Veterinary Genetics*. Claredon Press.

Ross CV. 1989. *Sheep Production and Management*. Prentice Hall.

Schmidt GM & Van Vleck LD. 1974. *Principles of Dairy Science*. WH Freeman.

Van Vleck LD, Pollak EJ & Bltenacu EAB. 1987. *Genetics for Animal Sciences*. WH Freeman.

AGB 607 CATTLE AND BUFFALO BREEDING 2+1

Objective

To educate about the concept of cattle and buffalo breeding.

Theory

UNIT I

History of dairy cattle and buffalo breeding. Breeds of cattle and buffalo and their Characterisation. Inheritance of important economic traits. Recording and handling of breeding data. Standardization of records. Computation of correction factors for the adjustment of the data. Estimation of breeding values of the cows and bulls.

UNIT II

Sire evaluation methods using single trait and multiple traits: construction of Sire indices, Sire evaluation under animal model, sire mode; and maternal grand sire model. Open nucleus breeding systems with MOET.

UNIT III

Methods of cross breeding. Breeding of type, milk quality and production efficiency. Plans for developing new breeds of dairy cattle. History of development of important breeds of dairy cattle.

UNIT IV

Considerations in the import of exotic germplasm for breeding cattle in the tropics. Appraisal of buffalo and cattle breeding programme. Role of breed associations in dairy improvement.

Practical

Performance recording – milk recording - Estimation of economic traits – Standardization of records – Index cards – Sire evaluation – Comparison of latest methods - Computation of genetic parameters – Genetic gain – Estimation of heterosis – Culling and replacement.

Suggested Readings

Lasley JF. 1987. *Genetics of Livestock Improvement*. 3rd Ed. IBH.

Nicholas FW. 1987. *Veterinary Genetics*. Clarendon Press.

Ross CV. 1989. *Sheep Production and Management*. Prentice Hall.

Schmidt GM & Van Vleck LD. 1974. *Principles of Dairy Science*. WH Freeman.

Van Vleck LD, Pollak EJ & Bltenacu EAB. 1987. *Genetics for Animal Sciences*. WH Freeman.

AGB 608

**SMALL FARM ANIMAL BREEDING
(Sheep, Goat, Swine and Rabbit)**

2+0

Objective

To educate about the small farm animal breeding concepts.

Theory

UNIT I

Breeds–Economic traits–Prolificacy–Breeding records and standardization.

UNIT II

Genetic parameters – Selection of males and females – Breeding systems. Development of new breeds.

UNIT III

Breeding policy – Breeding research – Conservation of breeds.

UNIT IV

Culling and replacement – EADR.

Suggested Readings

Ross CV. 1989. *Sheep Production and Management*. Prentice Hall.

Turner HN & Young SSY. 1969. *Quantitative Genetics in Sheep Breeding*. MacMillan.

Van Vleck LD, Pollak EJ & Bltenacu EAB. 1987. *Genetics for Animal Sciences*. WH Freeman.

AGB 609

POULTRY BREEDING

2+1

Objective

To educate about the advances in poultry breeding practices.

Theory

UNIT I

Origin and history of poultry species: Chicken, turkey, duck and quail – Important qualitative traits in poultry including lethals – Economic traits of egg-type chicken and their standardization – Selection criteria – Aids to selection: Index selection and Osborne index – Restricted selection index – Economic traits of meat – type chicken and their standardization.

UNIT II

Selection criteria and selection indices – Response to selection – Genetic controls – Genotype and environment interaction – Inbreeding, and its effects on production traits in egg and meat-type chickens – Inbred lines – Strain development – Crossing : strain and line crosses – Introduction to diallel cross – Utilisation of heterosis and reciprocal effect – Reciprocal recurrent selection and recurrent selection.

UNIT III

Industrial breeding – Artificial insemination in chicken – Autosexing – Random Sample Test.

UNIT IV

Biochemical variants and immunogenetics of poultry – Use of molecular genetics in poultry breeding – Quantitative trait loci and marker-assisted selection – Conservation of poultry genetic resources

Practical

Inheritance of qualitative traits – Economic traits of egg-type and meat-type chicken – Procedures of standardization – Estimations of heritability, correlation between various production traits, inbreeding co-efficient and heterosis – Selection of sires and dams – Osborne index – Restricted selection index – Collection and evaluation of semen and insemination – Diallel cross.

Suggested Readings

Crawford RD.1990. *Poultry Breeding and Genetics*. Elsevier.

Hutt FB. 2003. *Genetics of Fowl*. Norton Greek Press.

Singh RP & KumarJ. 1994. *Biometrical Methods in Poultry Breeding*. Kalyani.

AGB 610

LABORATORY ANIMAL BREEDING

1+0

Objective

To educate about the laboratory animal breeding principles.

Theory

UNIT I

Introduction to laboratory animal genetics – Breeding colonies of mice, rats, hamsters, guinea pigs and rabbits.

UNIT II

Selection and Mating methods/systems – monogamous, polygamous and others.

UNIT III

Development of genetically controlled laboratory animals – Rules for nomenclature, inbred strains, outbred stocks, mutant stocks, recombinant inbred strains, transgenic strains, gene targeting and production of ‘gene knock-out’ animals.

UNIT IV

Genetic control and monitoring – Record keeping – Ethics of laboratory animal use.

Suggested Readings

Van Vleck LD, Pollak EJ & Bltenacu EAB. 1987. *Genetics for Animal Sciences*. WH Freeman.

AGB 701 RECENT ADVANCES IN ANIMAL GENETICS 2+0

Objective

To impart knowledge about the latest tools and techniques of animal genetics and their uses in animal sciences.

Theory

UNIT I

Eukaryotic genome: Gene families, Pseudogenes SnRNPs, Gene conversion, tandemly repeated genes, Nuclear Organiser region, mRNA splicing, Minisatellites, Microsatellites and its usage.

UNIT II

Transposons, RNA processing Transcription regulation of gene expression, selective gene amplification, post transcriptional regulation. The proteasome and longevity of proteins.

UNIT III

Transgenic animals their benefits in livestock production, somatic cell nuclear transfer, transgenic animals in biomedical research, ethical consideration of transgenic animals; gene therapy and transgenic animal production. Pharming of Pharmaceutical.

UNIT IV

Radiation hybrid panels and their usage in livestock, microdissection of chromosomes, *In-situ* hybridization, chromosome painting, meiotic crossing over, genome selection; Structure and functions of major histocompatibility complex, T Cell receptor, CD4, Toll Like Receptors and their functions.

Suggested Readings

Selected articles from journals

AGB 702 RECENT TRENDS IN ANIMAL BREEDING 2+0

Objective

To acquaint with recent trends in animal breeding and designing of need-based breeding strategies.

Theory

UNIT I

Biometrical models and their analytical techniques on simulated and actual animal breeding data using computer application and use of programme in the field of animal breeding.

UNIT II

Formulation of detailed breeding plans ongoing breed improvement programmes and their impact analysis in various species of livestock under different situations.

UNIT III

Advanced techniques in genetic manipulation for multiplication and improvement of livestock species.

Suggested Readings

Selected articles from journals.

AGB 703 ADVANCES IN BIOMETRICAL GENETICS 2+1

Objective

To impart knowledge about recent advances in population genetic theory and application in animal breeding.

Theory

UNIT I

Mating designs; genetic basis of tripple test cross analysis (TTC); triallel analysis, partial diallel crosses and mating design for studying reciprocal and maternal differences.

UNIT II

Models for studying the inheritance of endosperm characters; classificatory problems; discriminant function, D2 analysis; principal component analysis.

UNIT III

Use of genetic parameters for prediction of recombinant inbred lines; advances in studies of genotype environment interaction and selection indices.

UNIT IV

Generation matrix and its use in population genetics; gene mapping of QTL (quantitative trait loci).

Practical

Estimation of genetic parameters – Diallel analysis – Triallel analysis – D2 analysis – Problems in Matrix.

Suggested Readings

Selected articles from journals.

AGB 704 ADVANCES IN SELECTION METHODOLOGY 2+1

Objective

To educate about the latest advances in selection theory and their application in animal breeding.

Theory

UNIT I

Fundamental theorem of natural selection; Selection in finite populations-effect on genetic structure and variance. Optimum designs for the estimation of genetic parameters. Design of selection experiments for testing selection theory.

UNIT II

Methods of measurement of genetic and environmental trends. Advances in selection indices Multistage, Restricted and retrospective selection indices.

UNIT III

Multi-information, Empirical evaluation of selection theory: genetic slippage, limits to selection, asymmetry of response, selection experiments, effect of selection on variance.

UNIT IV

Selection for threshold traits; single and multiple trait best linear unbiased estimation (BLUE) and prediction (BLUP); selection under single and multiple trait animal models; direct and correlated response through various selection indices, relationship between BLUP and selection index; fundamentals of marker assisted selections.

Practical

Estimation of relative economic values; determination of culling levels and selection intensity; construction of various indices; estimation of direct and correlated response; QTL analysis using LDMAS & LEMAS.

Suggested Readings

Selected articles from journals

AGB 705 BIOINFORMATICS IN ANIMAL GENETICS AND BREEDING 2+0

Objective

To educate about basic concepts of bioinformatics and their applications in Animal Genetics and Breeding.

Theory

UNIT I

Overview of bioinformatics, Database concepts, Algorithms, Information resources for protein and genome databases: Gene Bank, EMBL, SWISS-PROT, PROSITE.

UNIT II

Nucleotide and protein sequence analysis, Pair-wise and multiple sequence alignments, Phylogeny, Micro-array processing, Clustering, Analysis software, Secondary database search.

UNIT III

Genetic characterisation, Use of bioinformatics tools for identifying QTL and selection of elite germplasm.

Suggested Readings

Selected articles from journals.

AGB 706 ADVANCES IN MOLECULAR CYTOGENETICS 2+0

Objective

To educate about the advances in cytogenetics and their application in animal genetic and breeding

Theory

UNIT I

Structure of eukaryotic chromosomes – Evolution of karyotype – Various in vitro cell culture techniques – Cell lines and utility – Genotoxicity.

UNIT II

Somatic cell genetics – Stem cell genetics – Molecular cytogenetics and gene mapping – ISH, FISH, Radiation hybrid mapping, Fibre-FISH, PRINS.

UNIT III

Positional cloning – Spectral karyotyping.

UNIT IV

Image analysis – Chromosome walking – Chromosome painting.

Suggested Readings

Selected articles from journals.

AGB 707

**UTILISATION OF NON-ADDITIVE GENETIC VARIANCE 2+1
IN FARM ANIMALS**

Objective

To educate about the recent advances in estimation of non-additive genetic variation and possible use in developing synthetic population of livestock and poultry.

Theory

UNIT I

Heterosis – forms and genetic basis; detection and estimation of non-additive genetic variance – average dominance, overdominance.

UNIT II

Partitioning of between cross variance – general combining ability, specific combining ability and reciprocal effects; methods of analyzing diallel crosses; utilization of non-additive genetic variance.

UNIT III

Crossbreeding systems – crossbreeding effects; recurrent and reciprocal recurrent selection and their forms.

UNIT IV

Development of specialized sire and dam lines; inbred lines and their maintenance; inbreeding and hybridization.

Practical

Computation of degree of dominance using NC Plans; analysis of partial and complete diallel cross data; estimation of crossbreeding effects; estimation of genetic correlation among paternal purebred and crossbred half sibs; computation of response through RS and RRS.

Suggested Readings

Selected articles from journals.

ANIMAL GENETICS AND BREEDING

List of Journals

- ❖ Animal Biotechnology
- ❖ Animal Production
- ❖ Animal Reproduction Science
- ❖ Animal Genetics
- ❖ Animal Science
- ❖ Animal Genetic Resource Information
- ❖ Asian-Australian Journal of Animal Sciences
- ❖ Biochemical Genetics
- ❖ Biometrical Journal
- ❖ Biometrics
- ❖ Biodiversity and Conservation
- ❖ British Veterinary Journal
- ❖ Canadian Journal of Animal Sciences
- ❖ Canadian Journal of Genetics and Cytology
- ❖ Chromosoma
- ❖ Chromosome Research
- ❖ Current Genetics
- ❖ Current Genomics
- ❖ Current Opinion in Genetics and Development
- ❖ Cytogenetics and Cell Genetics
- ❖ Developmental Genetics
- ❖ DNA Sequence
- ❖ DNA and Cell Biology
- ❖ Evolution
- ❖ Gene
- ❖ Gene Expression
- ❖ Gene Therapy
- ❖ Genetica
- ❖ Genetics
- ❖ Genetics and Molecular Biology
- ❖ Genetical Research
- ❖ Genome Research
- ❖ Genomics
- ❖ Heredity
- ❖ Immunogenetics
- ❖ Indian Journal of Animal Science
- ❖ Indian Journal of Experimental Biology
- ❖ Indian Journal of Heredity
- ❖ Indian Journal of Animal Reproduction
- ❖ Japanese Journal of Breeding
- ❖ Journal of Animal Genetics & Breeding
- ❖ Journal of Dairy Research
- ❖ Journal of Dairy Sciences

- ❖ Journal of Heredity
- ❖ Journal of Animal Science
- ❖ Journal of Genetics & Breeding
- ❖ Journal of Research, HAU
- ❖ Journal of Research, PAU
- ❖ Journal of Rural Development
- ❖ Journal of Genetics
- ❖ Molecular Biology
- ❖ Theoretical and Applied Genetics
- ❖ World Animal Review
- ❖ World Review of Animal Production

e-Resources

- ❖ <http://www.ncbi.nlm.nih.gov/>
- ❖ <http://www.genome.gov>
- ❖ <http://www.hgsc.bcm.tmc.edu/projects/bovine>
- ❖ <http://www.animalgenome.org>
- ❖ <http://www.blackwell-synergy.com>
- ❖ <http://www.genomics.liv.ac.uk>
- ❖ <http://www.biomedcentral.com>
- ❖ <http://www.genomealliance.org.au>
- ❖ <http://www.csiro.au>
- ❖ <http://www.isag.org.uk>
- ❖ <http://www.ebi.ac.uk/imgt/>
- ❖ <http://www.csrees.usda.gov>

Suggested Broad Topics for Masters and Doctoral Research

- ❖ Animal Genetic Resources characterization and evaluation using field survey and molecular markers
- ❖ Animal Genetic Resource enhancement through selection/crossbreeding/reproductive biotechnology/molecular biology
- ❖ Identification of molecular markers for economic traits
- ❖ Genetic basis for improvement in quantitative traits
- ❖ Breeding tools for Sire evaluation
- ❖ Appropriate models for evaluating animal breeding values
- ❖ Transgenesis and gene transfer
- ❖ Genetics of Disease Resistance

ANIMAL NUTRITION
Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
ANN 601	ANIMAL NUTRITION – ENERGY AND PROTEIN	3+0
ANN 602	ANIMAL NUTRITION – MINERALS, VITAMINS AND FEED ADDITIVES	3+1
ANN 603	FEED TECHNOLOGY	1+1
ANN 604	FEED CONSERVATION ,STORAGE AND QUALITY CONTROL	2+2
ANN 605	RUMINANT NUTRITION	2+1
ANN 606	NON-RUMINANT NUTRITION	1+1
ANN 607	NUTRITION OF COMPANION/LABORATORY, WILD AND ZOO ANIMALS	2+1
ANN 608	RESEARCH TECHNIQUES IN ANIMAL NUTRITION	1+3
ANN 609	NON CONVENTIONAL FEED STUFF AND TOXIC CONSTITUENTS/ANTIMETABOLITES IN ANIMAL FEEDSTUFF	2+1
ANN 691	MASTER’S SEMINAR	1+0
ANN 699	MASTER’S RESEARCH	20
ANN 701	MODERN CONCEPTS OF FEEDING RUMINANTS AND FORAGE UTILIZATION	3+0
ANN 702	MODERN CONCEPTS OF FEEDING MONOGASTRIC ANIMALS	2+0
ANN 703	NUTRITION AND RUMEN FERMENTATION	1+1
ANN 704	ADVANCES IN MICRONUTRIENTS	1+0
ANN 705	ADVANCED TECHNIQUES IN NUTRITION AND RESEARCH	1+2
ANN 706	ADVANCES IN FEED TECHNOLOGY	1+1
ANN 707	CLINICAL NUTRITION	1+1
ANN 708	NUTRIENT AND DRUG INTERACTION	2+0
ANN 709	NEW FEED RESOURCES AND TOXICANTS IN ANIMAL FEEDING	2+0
ANN 791	DOCTORAL SEMINAR I	1+0
ANN 792	DOCTORAL SEMINAR II	1+0
ANN 799	DOCTORAL RESEARCH	45

ANIMAL NUTRITION

Course Contents

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

Measures of feed energy. Partitioning of feed energy. Efficiency of energy and Protein utilization. Feeding standards- comparative appraisal and limitations.

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

Energy balance, Fasting catabolism. Direct and indirect calorimetry. Determination of energy and protein requirements. Energy and protein requirement for maintenance, growth, pregnancy and lactation in ruminants, companion animals and poultry.

Suggested Readings

- Blaxter K. 1989. *Energy Metabolism in Animal and Man*. Cambridge Univ. Press.
- Bondi A. 1987. *Animal Nutrition*. Wiley InterScience.
- Crampton EW & Harris LE. 1969. *Applied Animal Nutrition*. WH Freeman.
- Maynard LA, Loosli JK, Hintz HF & Warner RG. 1987. *Animal Nutrition*. McGraw-Hill.
- McDonald P, Edwards RA & Greenhalgh JFD. 1995. *Animal Nutrition*. Longman.
- Ponds WG, Church DC, Pond KR & Schoknecht PA. 2005. *Basic Animal Nutrition and Feeding*. Wiley Dreamtech India.
- Singh UB. 1987. *Advanced Animal Nutrition for Developing Countries*. Indo-Vision.

Objective

Role, requirement, functions, deficiency and toxic effects of vitamins, essential, probably essential and toxic minerals. Understanding soil-plant-animal-human relationship for utilization of minerals. Recent trends in the use of feed additives, probiotics, prebiotic and enzymes in animal feeding.

TheoryUNIT I

Essential minerals, general role of minerals, soil-plant-animal-human relationship, requirement of minerals, factors affecting requirements. Macro elements and micro elements, their distribution, metabolism, physiological functions, deficiencies and excesses, requirements and sources. Probable essential minerals. Toxic minerals.

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

UNIT II

Critical minerals for ruminants and non-ruminants, chelates and chelated minerals. Inter-relationship of minerals with other nutrients. Impact of minerals arising from industrial effluent on animal health and production. Critical limits of minerals in edible herbage. Bioavailability studies in minerals. Impact of minerals on reproduction. Area specific minerals.

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

General principles of mineral estimation, Sampling and processing techniques, Estimation of macro- and micro-minerals. Determination of bioavailability of minerals. Formulation of mineral mixture for various species. Identification of adulterants and quality control. Atomic absorption spectrometry in mineral estimation. Preparation of diets for mineral studies. Principles of vitamin estimation. Estimation of some important vitamins (vitamin A, E, C). Formulation of vitamin mixture for various species.

Suggested Readings

- Banerjee GC. 1988. *Feeds and Principles of Animal Nutrition*. Oxford & IBH.
- Krishna G & Ranjhan SK. 1991. *Special Analytical Techniques*. Kalyani.
- McDonald P, Edwards RA & Greenhalgh JFD. 1995. *Animal Nutrition*. Longman.
- McDowell LR. 2003. *Minerals in Animal and Human Nutrition*. Reed Elsevier India.
- Peter RC. 2005. *Applied Animal Nutrition Feeds and Feeding*. Pearson Prentice Hall.
- Ponds WG, Church DC, Pond KR & Schoknecht PA. 2005. *Basic Animal Nutrition and Feeding*. Wiley Dreamtech India.

Reddy DV. 2003. *Principles of Animal Nutrition and Feed Technology*. Oxford & IBH.

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

ANN 603

FEED TECHNOLOGY

1+1

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

Banerjee GC. 1988. *Feeds and Principles of Animal Nutrition*. Oxford & IBH.

Givens DI. 2000. *Forage Evaluation in ruminant Nutrition*. Great Britain Publ.

Gohl BO. 1985. *Tropical Feeds*. FAO.

Lohan OP, Chahal SM & Kishore N. 1998. *Feed Quality Evaluation Techniques*. CCS Haryana Agricultural Univ. Press.

- McEllihner, Robert R. 1994. *Feed Manufacturing Technology*. The American Feed Industry Assoc.
- Perry TW. 2004. *Feeds and Feeding*. Prentice Hall.
- Ponds WG, Church DC & Pond KR. 1995. *Basic Animal Nutrition and Feeding*. John Wiley & Sons.
- Zaworski F. 1997. *Feed Industry Red Book*. ZMAG Publ.

ANN 604 FEED CONSERVATION, STORAGE AND QUALITY CONTROL 2+2

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

Proximate composition, Limitations of various systems of analysis, Partitioning of forage fibre by Van Soest method, Quality control of fed ingredients, Specifications of feed ingredients and finished feeds, BIS standard., Pesticide and insecticide residues in feeds

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

- Givens DI. 2000. *Forage Evaluation in Ruminant Nutrition*. Great Britain Publ.
- Khare BP. 1994. *Stored Grain Pests and their Management*. Kalyani.
- Krishna G & Ranjhan SK. 1991. *Special Analytical Techniques in Nutritional Biochemistry*. Kalyani.
- Lohan OP, Chahal SM & Kishore N. 1998. *Feed Quality Evaluation Techniques*. CCS Haryana Agricultural Univ. Press.
- McEllihner Robert R. 1994. *Feed Manufacturing Technology*. The American Feed Industry Assoc.
- Ponds WG, Church DC & Pond KR. 1995. *Basic Animal Nutrition and Feeding*. John Wiley & Sons.

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.

Suggested Readings

Dhority BA. 2003. *Rumen Microbiology*. Nottingham Univ. Press.
Kellems RO & Church DC. 2002. *Livestock Feeds and Feeding*. Prentice Hall.
Ranjhan SK. 2001. *Animal Nutrition in the Tropics*. Sangam Books.

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 amino acids-lysine and methionine.

UNIT II

Feeding systems and feed additives, feed formulations for different purposes including least cost rations.

UNIT III

Quality control of poultry and swine rations for efficient egg and meat production. Nutrition in relation to disease and stress.

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

Leeson S & Summers JD. 2005. *Commercial Poultry Nutrition*. International Publ. House.
Ponds WG, Church DC, Pond KR & Schoknecht PA. 2005. *Basic Animal Nutrition and Feeding*. Wiley Dreamtech India.
Rose SP. 1996. *Principles of Poultry Science*. CABI.
Stevan I, Scott ML & John DS. 2001. *Nutrition of the Chicken*. Univ. of Guelph.

ANN 607 **NUTRITION OF COMPANION, LABORATORY, WILD** **2+1**
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 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

Case LP. 1995. *Canine and Feline Nutrition*. St. Louis Publ.

Church DC. 1980. *Digestive Physiology and Nutrition in Ruminants*. Oxford Press.

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

Petter WL & Pearson AEG. 1971. *The Laboratory Animals- Principles and Practices*. Academic Press.

Reddy DV. 2003. *Applied Nutrition*. Oxford & IBH.

Robbins C & Cunha T. 1994. *Wildlife Feeding and Nutrition*. Reed Elsvier.

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

Cell Wall partitioning, Lignin as internal marker in feedstuffs, Mineral estimation by atomic absorption spectrophotometer, In-vitro/in-sacco determination of digestibility and digestion kinetics. Determination of energy content of feed, faeces and urine using bomb calorimeter. Methodology for quality improvement of animal feeds. Interpretation and presentation of results. Tracer techniques in Animal Nutrition. Quality evaluation of silage and hay, feed energy estimation; nitrate, urea, aflatoxin, salmonella, glycosides and sedimentation tests. Blood profile, meat quality.

Suggested Readings

Bondi AA. 1987. *Animal Nutrition*. Wiley InterScience.

Gupta PC, Khatta VK & Mandal AB. 1988. *Analytical Techniques in Animal Nutrition*. CCS HAU Press.

Pandey DN & Bajpai A. 2003. *Recent Trends in Animal Nutrition and Feed Technology for Livestock, Pets and Laboratory Animals*. International Book Distr.

Reddy DV. 2003. *Principles of Animal Nutrition and Feed Technology*. Oxford & IBH.

ANN 609

NON CONVENTIONAL FEEDSTUFFS AND TOXIC CONSTITUENTS/ANTIMETABOLITES IN ANIMAL FEEDSTUFF

2+1

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

- Banerjee GC. 1988. *Feeds and Principles of Animal Nutrition*. Oxford & IBH.
Liner IE. 1980. *Toxic Constituents of Animal Food Stuffs*. Academic Press.
Lohan OP, Chahal SM & Kishore N. 1998. *Feed Quality Evaluation Techniques*. CCS Haryana Agricultural Univ. Press.
McDonald P, Edwards RA & Greenhalgh JFD. 1995. *Animal Nutrition*. Longman.
Ponds WG, Church DC & Pond KR. 1995. *Basic Animal Nutrition and Feeding*. 4th Ed. John Wiley & Sons.
Ranjhan SK. 2001. *Animal Nutrition in the Tropics*. Sangam Books.
Reddy DV. 2003. *Principles of Animal Nutrition and Feed Technology*. Oxford & IBH.

ANN 701

MODERN CONCEPTS OF FEEDING RUMINANTS AND FORAGE UTILAZIATION 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

Concept of limiting amino acids for high yielders. Strategic feeding of high yielding dairy cows and meat producing ruminants. Concept of Phase feeding. Bypass Nutrient technology. Feeding during stress. Nutrition-immunity interaction. Designer milk and meat. Rumen manipulation to reduce methanogenesis. Nitrogen oxide emission and heavy metal residues. Metabolic profile tests.

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.

Newer methods of forage evaluation – calculated in vitro ME and DOMD by using prediction equations. Merits and demerits of using leaf protein. Top feeds and their effective utilization – pasture consumption and evaluation studies.

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

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

Leeson S & Summers JD. 2005. *Commercial Poultry Nutrition*. International Publ. House.

Ponds WG, Church DC, Pond KR & Schoknecht PA. 2005. *Basic Animal Nutrition and Feeding*. Wiley Dreamtech India.

Selected articles from journals

ANN 703 NUTRITION AND RUMEN FERMENTATION 1+1

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****1+0****Objective**

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

TheoryUNIT 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

Peter RC. 2005. *Applied Animal Nutrition Feeds and Feeding*. Pearson Prentice Hall.

Ponds WG, Church DC, Pond KR & Schoknecht PA. 2005. *Basic Animal Nutrition and Feeding*. Wiley Dreamtech India.

Selected articles from journals.

ANN 705**ADVANCED TECHNIQUES IN NUTRITION AND RESEARCH****1+2****Objective**

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

TheoryUNIT 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.

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

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 – Formulation 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 II

Effect of coccidiostats and dietary antigens in early weaned livestock. Nutrition in relation to emerging diseases. Effect of nutrition on fertility, reproduction and lactation. Toxic minerals and counter action (Selenium and fluorine).

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

Nutrients in drug detoxification – Antagonists – Hormones and their effect on growth and carcass qualities. Drug residues in animal products - milk and meat – effect on food change. Legal aspects of drugs in animal products.

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.

ANIMAL NUTRITION

List of Journals

- ❖ Animal feed science and technology
- ❖ Animal research
- ❖ Animal science journal
- ❖ Archives of animal nutrition
- ❖ British journal of nutrition
- ❖ British poultry science
- ❖ Grass and forage science
- ❖ International journal of sheep and wool science
- ❖ Italian journal of animal science
- ❖ Journal of animal and feed sciences
- ❖ Journal of animal physiology and animal nutrition
- ❖ Livestock research for rural development
- ❖ Malaysian journal of nutrition
- ❖ Nutrition journal
- ❖ Pakistan journal of nutrition
- ❖ Small ruminant research
- ❖ Animal nutrition and feed technology
- ❖ Australian journal of animal sciences
- ❖ Canadian journal of animal sciences
- ❖ Feed industry review
- ❖ Feed international
- ❖ Feed management
- ❖ Feed stuffs
- ❖ Feed trends
- ❖ Indian journal of animal nutrition
- ❖ Indian journal of animal science
- ❖ Indian journal of dairy science
- ❖ Indian journal of poultry sciences
- ❖ Journal of animal nutrition
- ❖ Journal of food science and technology

e-Resources

- ❖ <http://www.vivo.colostate.edu/hbooks/pathphys/digestion/index.html>
- ❖ <http://www-biol.paisley.ac.uk/kinetics/contents.html>
- ❖ http://en.wikipedia.org/wiki/Enzyme_kinetics#column-one
- ❖ <http://mark.asci.ncsu.edu/SwineReports/2004-2005/Contents.htm>
- ❖ <http://www.das.psu.edu/dairynutrition/>
- ❖ <http://www.vet.ed.ac.uk/clive/cal/RUMENCAL/Frames/frmMega.html>
- ❖ <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.clfmaofindia.org/>

- ❖ www.nianp.res.in/
- ❖ <http://www.nutrisocietyindia.com/>
- ❖ <http://www.fao.org>
- ❖ http://www.codexalimentarius.net/web/index_en.jsp
- ❖ <http://www.ars.usda.gov>
- ❖ <http://www.fao.org/ag/AGA/AGAP/FRG/afris/default.htm>
- ❖ <http://www.aphca.org/>
- ❖ <http://www.fao.org/ag/AGA/AGAP/FRG/frg1.htm>
- ❖ <http://www.fao.org/prods/index.asp>
- ❖ <http://www.fao.org/ag/AGA/AGAP/FRG/Feedsafety/feedsafety.htm>

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 through 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

LIVESTOCK PRODUCTION AND MANAGEMENT

Course Structure - at a Glance

CODE	COURSE TITLE	CREDITS
LPM 601	CATTLE AND BUFFALO PRODUCTION AND MANAGEMENT	2+1
LPM 602	SHEEP AND GOAT PRODUCTION AND MANAGEMENT	2+1
LPM 603	SWINE PRODUCTION AND MANAGEMENT	1+1
LPM 604	LABORATORY ANIMAL PRODUCTION AND MANAGEMENT	1+1
LPM605	SHELTER MANAGEMENT	1+1
LPM 606	PRINCIPLES OF ENVIRONMENTAL HYGIENE AND WASTE MANAGEMENT	2+0
LPM 607	CLIMATOLOGY AND ANIMAL PRODUCTION	1+0
LPM 608	POULTRY FARM AND HATCHERY MANAGEMENT	2+1
LPM 609	FARM ANIMAL BEHAVIOR	1+0
LPM 610	INTEGRATED LIVESTOCK FARMING SYSTEM	2+1
LPM 611	EQUINE PRODUCTION AND MANAGEMENT	1+1
LPM 612	WILD LIFE MANAGEMENT AND CONSERVATION	2+0
LPM 613	LIVESTOCK BUSINESS MANAGEMENT	1+1
LPM 691	MASTER'S SEMINAR	1+0
LPM 699	MASTER'S RESEARCH	20
LPM 701	ADVANCES IN CATTLE AND BUFFALO PRODUCTION AND MANAGEMENT	3+0
LPM 702	ADVANCES IN SHEEP AND GOAT PRODUCTION AND MANAGEMENT	2+1
LPM 703	ADVANCES IN SWINE PRODUCTION AND MANAGEMENT	2+1
LPM 704	ADVANCES IN LABORATORY ANIMAL PRODUCTION AND MANAGEMENT	1+0
LPM 705	ADVANCES IN POULTRY PRODUCTION MANAGEMENT	2+1
LPM 706	ADVANCES IN ENVIRONMENTAL MANAGEMENT	1+1
LPM 707	ADVANCES IN EQUINE MANAGEMENT	2+0
LPM 791	DOCTORAL SEMINAR I	1+0
LPM 792	DOCTORAL SEMINAR II	1+0
LPM 799	DOCTORAL RESEARCH	45

LIVESTOCK PRODUCTION AND MANAGEMENT

Course Contents

LPM 601 CATTLE AND BUFFALO PRODUCTION AND MANAGEMENT 2+1

Objective

To acquaint students on basic aspects of dairying in India compared with developed countries, problems and prospectus of dairying, detailed aspects of care and management of different classes of dairy cattle and buffaloes.

Theory

UNIT I

Introduction – Development of Dairy Industry in India and world - Present status and future prospects of livestock development in India

UNIT II

Important breeds of cattle and buffalo, traits of economic importance and their inter-relationships - Selection of high quality animals - Role of management in improving the reproduction efficiency in farm animals. - Housing and rearing systems.

UNIT III

Breeding Management: System of breeding Economic traits. Methods of Breeding - Prenatal and postnatal care and management of cattle and buffalo - Care of neonate and young calves - Management strategies for reducing mortality in calves, age at first calving and calving interval in cattle and buffaloes.

UNIT IV

Management of labour, Milking management, Machine milking and hand milking, Different laws governing the livestock sectors to produce quality products on par with international standards - Technique of harvesting clean and hygienic livestock products, transportation of animals, health management. Wallowing in buffaloes- Management of draught animals and summer management

UNIT V

Feed and fodder resources used for feeding of cattle and buffaloes– Scientific technique of feeding, watering – Computation of practical and economical ration, supply of green fodder around the year and enrichment of poor quality roughages.

Practical

Visits to cattle farms and critical analysis of various types of managerial practices - Study of breeding management in the farm- Analysis of practical feeding management- Disease control- Housing – milking - calf, heifer and adult management- Dairy Cattle and Buffalo judging - Project preparation for external funding and commercial farms and enterprises for dairy products – marketing strategies for milk and milk products and meat.

Suggested Readings

Arora SP. 1997. *Feeding of Dairy Cattle and Buffaloes*. Kalyani.

Dutta G. 1994. *Care and Management of Dairy Cattle and Buffaloes*. 3rd Ed. ICAR.

Thomas CK & Sastry NSR.1991 *.Dairy Bovine Production*. Kalyani.

LPM 602 SHEEP AND GOAT PRODUCTION AND MANAGEMENT 2+1

Objective

To acquaint students on status of sheep and goat farming in India, importance of record keeping, principles of housing and feeding, breeding management to improve the reproductive efficiency and detailed account on care and management of different classes of sheep and goat.

Theory

UNIT I

Introduction - Population structure and importance- Advantages and disadvantages of sheep farming under different systems of management – type of housing and equipments- Important sheep and goat breeds- Advantages and disadvantages of sheep and goat farming.

UNIT II

Breeding Management: Breeding seasons - fitness of purchase for first breeding - methods of detection of heat - Natural Service and artificial insemination - Care of the pregnant Animals - Breeding stock - Use of teaser - Culling.

UNIT III

Feeding Management: Feeding methods - Principles to be followed in feeding and watering- feeder space, waterer space, Designing feeders and waterers. - Range management - Stocking rate and pasture improvement and utilization; management under stall fed conditions, Transportation of sheep and goat.

UNIT IV

Disease Management: Role of management in the prevention and control of diseases. Special Management: Deworming - Dipping and spraying- shearing - Avoidance of goaty odour in milk, Topping

UNIT V

Wool: Importance of wool - Fiber structure- Fleece characters - Goat fibers - Characters of mohair and pashmina, fur and Angora - Marketing of goat fibers / wool.- Planning of sheep and goat farm of various sizes - Economics of sheep and goat farming.

Practical

Visit to sheep and goat farms and critical analysis of various managerial practices under different conditions. Study of practical housing management - Analysis of practical diseases control management - Shearing management - Record keeping. - Preparation of project for commercial farming - Characterization of sheep and goats; handling of sheep and goat; daily and periodical operations for sheep and goats - Methods of identification of sheep and goat. Cost of rearing sheep and goat for mutton and wool - Housing plans for various age and categories of sheep and goat - Dipping; Vaccination of sheep and goat - Shearing of wool.

Suggested Readings

- Devendra C & Mecleroy GB. 1982. *Goat and Sheep Production in Tropics*. Longman.
- Gupta JL. 2006. *Sheep Production and Management*. BS Publ.
- ICAR. 2002. *Handbook of Animal Husbandry 3rd Ed*. ICAR.
- Kaushish 1994. *Sheep Production in the Tropics and Sub Tropics*. Scientific Publ.

LPM 603

SWINE PRODUCTION AND MANAGEMENT

1+1

Objective

To impart knowledge on various aspects of swine farming in India, principles of housing, breeding, feeding and health care of pigs, management practices at different stages of growth and economic pig production systems.

Theory

UNIT I

Introduction - Population and importance - Economic contribution of pigs - Advantages and disadvantages of swine keeping - Systems of management - Problems in pig farming.

UNIT II

Breeds of pigs - Selection of breeding stock - Breeding seasons - Age and weight at first services - Methods for detection of heat – Natural service and artificial insemination - Care of pregnant sows, piglets and growers - Care of breeding boar.

UNIT III

Housing, sanitation and hygiene, disease prevention measures - Housing and equipment –Wallowing - Sanitation and hygiene - Role of management in the prevention and the control of diseases.

UNIT IV

Feeding and management of new born, weaner and finishers, dry, pregnant and farrowing sows - Feeding principles to be followed - Methods of watering – Feeder space – Water space, etc - Marketing: Methods of marketing in swine production - Record keeping.

Practical

Visits to piggeries and critical Analysis of various types of managerial practices - Analysis of the trend and structures of pig population - Analysis of practical breeding management methods, practical disease control management - special management methods - Ageing and identification – Judging - Constraints and remedial measures in pig farming - Economics of production - Project preparation for research and commercial farms.

Suggested Readings

- Boden (e) S.1995. *Swine Practice*. WB London.
- Narayankhedkar SG. 1997. *Production and Management of Swine, Camel, Equine and Yak*. Tindall Publ.

horses, dairy cattle, calves, bulls, work cattle, dogs, pigs, sheep, goats, and poultry.

UNIT III

Improvement of existing buildings; water supply; feed and fodder delivery systems - Economics of Livestock housing.

UNIT IV

Housing - Disease control measures and sanitation of all classes of livestock

Practical

Score card for animal houses - Time and motion study in Animal houses - Preparation of plans for Animal houses for horses, cattle, sheep, pigs, goats, and other livestock - Dogs and other pet animals - Economics of livestock housing - Preparation of plan for animal houses of different sizes and climatic zones of India.

Suggested Readings

Sastry NSR & Thomas CK. 2006. *Livestock Production and Management*. Kalyani.

Thomas CK & Sastry NSR 1991. *Dairy Bovine Production*. Kalyani.

Wathes CM & Charles DR. 1994. *Livestock Housing*. CABI.

LPM 606

PRINCIPLES OF ENVIRONMENTAL HYGIENE AND WASTE MANAGEMENT

2+0

Objective

To familiarize students on principles of air and water hygiene with reference to impurities and inclusions of water, collection and disposal of waste from the animal house, modern techniques in manure disposal and biosecurity measures to be adapted for hygienic production of livestock products.

Theory

UNIT I

Animal air hygiene: Definition - Composition of air - Air pollution - Factors affecting outdoor and indoor pollution - Assessment of these factors on animal health and production - Methods to control these factors.

UNIT II

Water Hygiene: Importance of water - Impurities and inclusions - Sterilization - Examination of water and water supplies - Collection of samples- Topographical physical, chemical, bacteriological and microscopic examination of water - Hygienic requirements and standards for drinking water - Quantity of water required by domestic animals - Methods of watering.

UNIT III

Manure - Quantity of manure voided by domestic animals - Animal excreta a factor in spread of disease - Hygienic and economic disposal of farm waste - Modern techniques used in automation / semi-automation in disposal of farm waste.

UNIT IV

Environmental protection act, Air (Prevention and control of pollution) act and water (Prevention and control of pollution) act - Biosecurity measures to be adapted for efficient and healthy production

UNIT V

Effect of environmental pollution on livestock and its products directly and indirectly - Controlling environmental pollution - Different factors affecting the quality of livestock and its products meant for human consumption

Suggested Readings

- Baba MD. 2007. *Environmental Changes and Natural Disasters*. New India Publ.
- Overcash MR. 1983. *Livestock Waste Management*. CRC Press.
- Thapliyal DC & Misra DS. 1996. *Fundamentals of Animal Hygiene and Epidemiology*. International Book Distr. Co.

LPM 607 CLIMATOLOGY AND ANIMAL PRODUCTION 1+0

Objective

To familiarize students on climate, weather, various climatic factors and their role in production and health of animals in both temperate and tropics, micro and macroclimatic conditions of animal house and assessing the heat tolerance of bovines.

Theory

UNIT I

Definition of climate -Classification of climatic regions - Climatic factors-Assessment of climate - Study of climatic factors in relation to animal production.

UNIT II

Light, natural and artificial light-mechanism of light action-photo period and light responses – Applications - Importance of light in production of animals and birds.

UNIT III

Introduction of breeds into different climatic regions - Agro meteorology and weather forecasting for Animal Husbandry activities - Micro climate modification in animal houses.

UNIT IV

Estimation of microclimatic conditions in Animal house - Measurement of Temperature, Relative humidity, Air Velocity and Mean temperature of the surrounding, measurement of intensity of light in animal houses - Construction of climographs and hythergraphs -Estimation of cooling power of atmosphere-heat tolerance test in bovines.

Suggested Readings

- Lal DS. 1998. *Climatology*. Sharda Pustak Bhavan, Allahabad.
- McDowell RE. 1972. *Improvement of Livestock Production in Warm Climates*. WH Freeman.
- Siddhartha K & Roger B. 1996. *Atmosphere, Weather and Climate*. ELBS.

LPM 608 POULTRY FARM AND HATCHERY MANAGEMENT 2+1

Objective

To acquaint students on basic aspects of housing, feeding, breeding and health care of poultry and comparing the performance under cage and floor system of

management of poultry, biosecurity measures to be followed to reduce mortality and efficient hatchery management to produce healthy young ones.

Theory

UNIT I

Poultry housing systems Cage Vs floor system, litter management and lights for poultry, rearing turkey, duck and quails.

UNIT II

Management of chicks, growing, laying and breeding flocks, broiler production, selection and culling of laying flocks.

UNIT III

Procuring, care and pre-incubation storage of hatching eggs - Method of incubation, sanitation disinfection and management of hatchery.

UNIT IV

Embryonic development and factors effecting fertility and hatchability of eggs.

UNIT V

Chick sexing, packing and hatchery business - Transporting management of farm and hatchery waste.

Practical

Poultry Farm management - Brooding of chicks; selection of laying flocks - Disease preventive measures - Selection and care of hatching eggs; incubator operation, fumigation and candling setting and hatching, packaging of chicks - Waste management - Marketing of products.

Suggested Readings

- Ensminger ME. 1992. *Poultry Science*. International Book Distr. Co.
Hued LM. 2003. *Modern Poultry Farming*. Greenworld.
Powell-Owen W. 2008. *Poultry Farming and Keeping*. Daya Books.
Prashad J. 2005. *Poultry Production and Management*. Kalyani.
Singh RA. 1996. *Poultry Production*. 3rd Ed. Kalyani.

LPM 609

FARM ANIMAL BEHAVIOR

1+0

Objective

To make acquainted students on principles of farm animal behaviour with regard to environmental influence, group formation, social behaviour and behavioural adaptations under domestication.

Theory

UNIT I

Introduction to Animal behaviour - Importance of animal behaviour studies - Patterns of behaviour - Daily and seasonal cycles of behaviour - Physiological basis of behaviour.

UNIT II

Environmental modification of behaviour - Developmental changes in behaviour - Genetic differences in behaviour - Behavioural disorders.

UNIT III

Group formation - Social relationship, process of socialisation locality and behaviour - Practical application - Behavioural character for managemental

practices - Favourable and unfavourable behaviour for domestication - Behavioural adaptations under domestication.

UNIT IV

Physical environment and behaviour - Common vices and their remedial measures - Analysis of behaviour in relation to location - Analysis of behaviour in relation to climatic environment - Analysis of social behaviour.

Suggested Readings

Arora MP. 1995. *Animal Behaviour*. WB London.

Bouenger EG. 1994. *Animal Behaviour*. WB London.

Fraser AF & Broom DM. 1997. *Farm Animal Behaviour and Welfare*. CABI.

Fraser AF & Broom DM. 1999. *Farm Animal Behaviour and Welfare*.

Kumar V. 1996. *Animal Behaviour*. WB London.

LPM 610 INTEGRATED LIVESTOCK FARMING SYSTEM 2+1

Objective

To familiarize on various aspects viz., scope and limitations of integrated livestock farming system, recent approach and economic feasibility of different integration models for sustainable production

Theory

UNIT I

Scope and limitation of integrated farming systems - Sustainability of integrated Livestock Farming Systems and their economic importance.

UNIT II

Integration of fish, arable farming and different livestock enterprises vis-à-vis gobar gas plant, FYM, solar and wind energy utilization, cattle, buffalo sheep, goat, pig, poultry, rabbit, silk worm, bee keeping etc.

UNIT III

New approach for changing farming systems in present energy crises.

UNIT IV

Project formulation and evaluation of various livestock enterprises.

Practical

Various livestock farming units and their economic analysis - Evaluation of different farming systems and their economic importance - Preparing feasibility report for various farming projects.

Suggested Readings

Mukherjee TK. 1992. *Integrated Livestock Fish Production Systems*.

Raman KV & Balaguru T. (Eds.). 1992. *Farming Systems Research in India: Strategies for Implementation*. NAARM.

Renard C. (Ed.). 1997. *Crop Residues in Sustainable Mixed Crop/Livestock Farming Systems*. CABI.

Speirs M. & Opsen O. 1992. *Indigenous Integrated Farming System in the Sahel*. World Bank.

LPM 611

EQUINE PRODUCTION AND MANAGEMENT

1+1

Objective

To educate the students become familiarize with principles of housing, breeding, feeding and health care of different classes of horse, stable routines and measures to reduce the mortality in young ones at different seasons .

Theory

UNIT I

Equine population in India - Breeds of native and exotic horses - Types and classes of light and work horses

UNIT II

Housing and routine management practices –Hygiene and maintenance of stable. Color and markings, Dentition and ageing selecting and judging horses- unsoundness and stable vices

UNIT III

Feeding and breeding of horses donkey and Mules, foaling, care of foal

UNIT IV

Foot care and shoeing care, Stud farms - Race clubs - Race horses and their care - Horse behaviour and training - Exercising - Basic Horsemanship

UNIT V

Health management & diseases control. Control of internal and external parasites of horse- Colic and its prevention

UNIT VI

Mode of transport - Facilities requirement - Cleaning, disinfection and preparation of vehicles Transport stress - Management during transport - Regulatory acts of states and centre in animal disease control and welfare. Precautions and requirements before, during and after transport - Laws governing the import and export of livestock and its products- - Horse passport and trading

Practical

Control of horse for examination, passing of stomach tube, dentition and ageing, saddling, exercising of horse, hoof care.

Suggested Readings

- Blancchard TL et al. 2002. *Manual of Equine Reproduction*. Mosby Publ.
Frape D. 1986. *Equine Nutrition and Feeding*. Blackwell Publ.
Kacker RN & Panwar BS. 1996. *Text Book of Equine Husbandry*. Vikas Publ.
Mills DS & Nankervis KJ. 1998. *Equine Behaviour: Principles and Practice*. Blackwell Publ.
Pilliner S. 1994. *Care of the competition Horse*. BT Batsford.
Rose RJ & Hodgson DR. 2000. *Manual of Equine Practice*. WB Saunders.

LPM 612

WILD LIFE MANAGEMENT AND CONSERVATION

2+0

Objective

To acquaint students with the principles and concepts of wild life sanctuaries and national parks, classification of wild animals, role of authorities in conservation and management of wild animals in captivity.

Theory

UNIT I

Zoo and captive wild animals - Principles and concepts – Ecology of wild life sanctuaries and National parks- wild life legislation in India - Status of forest in India - Biological and ecological basis of management of wild life.

UNIT II

Voluntary organization on wild life - Rules and regulations of zoo authority of India -Wild life protection act - Zoological classification of wild animals - Funding agencies for wild life research and preparation of project. - Conservation of wild animals.

UNIT III

Wild life health control - Reproduction in zoos - Population analysis - Population manipulation - Habit analysis and design - The resources and its management - Distribution of important Indian animals - Zoo animals and birds - Breeding characteristics – Movements - Cover requirements - Food - Population density – Mortality - Nesting losses caused by predators, predator and prey relationship - Human interference - Refuge rehabilitation

UNIT IV

Restraints - Maps - Survey and plans of management systems - Principles, protective measures - Development and conservation of water supply- puberty - Breeding seasons - pregnancy - Parturition - Lactation postnatal survival of the young - Social factors among various species - Miscellaneous management procedures.

Suggested Readings

Berwick SH & Saharia VB. (Eds.). 1995. *The Development of International Principles and Practices of Wild Life Research and Management*. Deford Univ. Press.

Bobbins CT. 1983. *Wild Life Feeding and Nutrition*. Daya Publ. House.

Giles RH. 1978. *Wild Life Management*. Wild Life Society.

Giles RH. 1984. *Wild Life Management Techniques*. 3rd Ed. Wild Life Society.

Jadhav NV, Baig MI & Devangare AA. 2004. *Handbook of Wild Animals and Livestock Management*.

WWF. 1994. *Wild Life (Protection) Act 1972 (as Amended up to 1991)*. Natraj Publ.

LPM 613

LIVESTOCK BUSINESS MANAGEMENT

1+1

Objective

To acquaint students with knowledge in principles, planning, technical approach and preparing financial statement in Livestock Business Management and preparing projects for financing.

Theory

UNIT I

Management principles - Planning - Techniques, strategic planning, organization structure, co-ordination and controlling techniques - Approaches to management.

UNIT II

SWOT analysis, financial accounting - Accounting records - Balance sheet, fund flow statement - Cost and analysis for managerial decisions - Budgeting and control .

UNIT III

Tools of financial analysis, working capital financing - Long term financial management - Investment analysis - Capital markets - Corporate risk management - Venture capital.

UNIT IV

Marketing - Objectives, strategies - Selecting and managing marketing channels - Pricing strategies - Sales promotion - Legislation relating licensing - Company law.

Practical

Preparation of financial statements, depreciation accounting methods, trend and variance analysis, cost-volume profit analysis - Financial planning and forecasting - Estimation of working capital requirement - Break even analysis - Visit to livestock business firms and banks - Preparing projects for financing.

Suggested Readings

Koontz H & O'Donnel C. 1999. *Essentials of Management*. Tata McGraw Hill.

Kotler P. 2000. *Marketing Management – Analysis, Planning and Control*. Prentice Hall of India.

Maheswari SN. 1998. *Management Accounting*. Tata McGraw Hill.

Massie JL. 1995. *Essential of Management*. Prentice Hall of India.

Srinivasan NP. 1998. *Management Accounting*. Sterling Publications.

LPM 701

ADVANCES IN CATTLE AND BUFFALO PRODUCTION AND MANAGEMENT

3+0

Objective

To acquaint students on latest developments on dairying in India compared with developed countries, problems and prospectus of dairying, detailed aspects of care and management of different classes of dairy cattle and buffaloes.

Theory

UNIT I

Dairy farming in India – Global scenario - Present status and reasons for the same – Avenues for progress – The needs of the nation and how to achieve it.

UNIT II

Advances in housing management of dairy cattle and buffaloes in various agroclimatic zone of India - Management systems for cattle and buffaloes.

UNIT III

Establishing Dairy Cattle Enterprise – Characteristics of a successful dairy farm – Choice of the foundation stock – Breeding Management Problems associated with reproduction.

UNIT IV

Advances in Feeding Management of cattle and buffalo, Feed for milking herd, dry cows, bulls and calves, Management of high yielding animals.

UNIT V

Milking Management – Biosynthesis of milk - Factors affecting the composition and yield of milk - milk ejection reflex - Milking systems – Sanitary standards for the f quality milk – Cessation of milking, advances in herd management- raising calves – growing heifers, replacements and culling – marketing, Computerization of dairy enterprises.

UNIT VI

Advance in health management of dairy animals, metabolic diseases of high yielders- advances in preventive measures for production related diseases

Suggested Readings

Clarence HE . 2007. *Dairy Cattle & Milk Production*. Daya Publ. House.

Selected articles from journals.

Thomas CK & Sastry NSR. 1991. *Dairy Bovine Production*. Kalyani.

LPM 702

ADVANCES IN SHEEP AND GOAT PRODUCTION AND MANAGEMENT

2+1

Objective

To educate the students on advances in sheep and goat farming for improving their productivity through different management practices.

Theory

UNIT I

Utility origin – Domestication - Numbers and distribution of meat and dual purpose breeds - Methods of rearing – Range sheep production –

UNIT II

The farm flock – Pure bred flock - Management during breeding season - The sexual seasons and its control - Puberty – Time of the year to breed – Flushing – Ram-Ewe ratio.

UNIT III

Advances in feeding management, Nutrient deficiencies in range forage, Feed to supplement range forage, General feeding practices, Feeding materials, Lamb feeding, Use of antibiotics and hormones, Hand feeding, Self feeding, Pellet feeding , Feeding lambs and ewes during lactation.

UNIT IV

Recent development in sheep and goat management and their relevance under Indian economic conditions, needs and possibilities for future research.

UNIT V

Role of sheep husbandry in dry farming in India, Present development programmes in sheep and goat production, Advances in reproduction, housing, feeding and watering, diseases, Shearing methods and culling of sheep and goat.

& guinea pigs, measures to reduce the mortality in young ones at different seasons .

Theory

UNIT I

Importance and limitations of rabbits for meat and fur production, rats, mice & guinea pigs - Common breeds and strains .

UNIT II

Advances in system of housing, Common diseases and their control measure .

UNIT III

Breeding strategies - Age at maturity, litter size , Weaning, Feeding of growers, Selection of replacement stock, transportation of rabbit.

UNIT IV

Transportation of Laboratory animals – marketing of meat and fur.

UNIT V

Management of specific pathogen free and gnotobiotic animals ,concepts to related to welfare of laboratory animals

Practical

Visit to Rabbit farms - Study of the various chores in government farms and private farms - Critical analysis of breeding, feeding, disease control management and housing - Rabbit slaughter technique.

Suggested readings

Selected articles from journals.

LPM 705 ADVANCES IN POULTRY PRODUCTION MANAGEMENT 2+1

Objective

To educate the students on advances in housing, feeding, breeding and health care in poultry farming.

Theory

UNIT I

Planning, organisation, executive and management of poultry farms and hatcheries of various sizes - alternative in poultry production

UNIT II

Demand, supply, present status of poultry production.

UNIT III

Problems and new management techniques in poultry for egg and meat in India vis-à-vis in other countries of the world, automation in poultry houses, management of specific pathogen free flocks.

UNIT IV

Poultry development policies and planning for higher production constraints in development and solutions, Ethology and entology in relation to poultry production

Practical

Planning and preparation of research and commercial projects on broiler and layer production management.

Suggested Readings

Selected articles from journals.

LPM 706

ADVANCES IN ENVIRONMENTAL MANAGEMENT

1+1

Objective

To educate the students on advances in climate, weather, various climatic factors monitoring and their role in production and health of animals in both temperate and tropics, micro and macroclimatic conditions of animal house and environmental influences on the performance of farm animal production.

Theory

UNIT I

The animal Industry and the quality of the environment – Management of the living environment - Microenvironment and macro environment.

UNIT II

Air Pollution: Indoor and out door - Chemical, physical and bacteriological changes - Causes – Standards and the extent tolerated by animals - Effects on animal production.

UNIT III

Fixing standards in relation to CO₂ - Air supply in relation to cubic space, temperature, air, velocity, relative humidity, dust particles, bacterial count, effective temperature and cooling power - Methods to get over pollution – Cleaning and washing - Air conditioning.

UNIT IV

Utilisation and disposal of animal waste, Health hazards, Waste utilization, technologies for processing and treatment of animal wastes, Health and economic impacts, Legal constraints, Microbiology of wastes, Waste properties, Gases and odour.

UNIT V

Water Pollution: Significance, treatment and control - Funding agencies for animal welfare

Practical

Assessment of various factors in Indoor and outdoor environment- Assessment of CO₂, air supply, dust particles and bacterial count in air - Visit to sewage treatment plant - Planning farm waste disposals - Physical chemical and bacteriological examination of water watering of farm animals.

Suggested Readings

Baba MD. 2004. *Environmental Changes and Natural Disasters*. New India Publ. Agency.
Selected articles from journals.

LPM 707

ADVANCES IN EQUINE MANAGEMENT

2+0

Objective

To familiarize the students on latest aspects of principles of housing, breeding, feeding and health care of different classes of horse, stable routines and measures to reduce the mortality in young ones at different seasons.

Theory

UNIT I

New indigenous and exotic horses breeds- Types and classes of light and work horses

UNIT II

Advances in housing and routine management practices –Hygiene and maintenance of stable. Color and markings, Dentition and ageing selecting and judging horses- unsoundness and stable vices

UNIT III

New Feeding techniques and breeding of horses donkey and Mules, foaling, care of foal

UNIT IV

Foot care and shoeing care, Stud farms,Race clubs,Race horses and their care, Horse behaviour and training, Exercising ,Basic Horsemanship

UNIT V

Advances in health management & diseases control. Control of internal and external parasites of horse- Colic and its prevention

UNIT VI

Mode of transport, Facilities requirement, Cleaning, disinfection and preparation of vehicles Transport stress,Management during transport , Regulatory acts of states and centre in animal disease control and welfare. Precautions and requirements before, during and after transport, Laws governing the import and export of livestock and its products, Horse passport and trading.

Suggested Readings

Selected articles from journals.

LIVESTOCK PRODUCTION AND MANAGEMENT

List of Journals

- ❖ Asian Journal of Buffalo Production and Management
- ❖ Australian Journal of Animal Science
- ❖ British Poultry Science
- ❖ Canadian Journal of Animal Science
- ❖ Indian Dairyman
- ❖ Indian Journal of Animal Nutrition
- ❖ Indian Journal of Animal Production and Management
- ❖ Indian Journal of Animal Science
- ❖ Indian Journal of Dairy Science
- ❖ Indian Journal of Poultry Science
- ❖ Indian Journal of Field Veterinarians
- ❖ Internal Journal of Animal Science
- ❖ Journal of Animal Sciences
- ❖ Journal of Dairy Sciences
- ❖ Livestock Production Science
- ❖ Poultry Science
- ❖ The Indian Veterinary Journal
- ❖ World Poultry Science Journal

e-Resources

- ❖ www.pork.org
- ❖ www.ilri.org
- ❖ www.fao.org
- ❖ www.defra.org.uk
- ❖ www.aciar.gov.au
- ❖ www.asap.asn.au
- ❖ www.thepigsite.com
- ❖ www.epa.com
- ❖ <http://animalscience.ucdavis.edu>
- ❖ www.tanu.edu
- ❖ www.sciencedirect.com
- ❖ <http://trop.edmgr.com>
- ❖ www.nianp.res.in/
- ❖ <http://www.aphca.org>
- ❖ <http://www.ars.usda.gov>

Suggested Broad Topics for Master's and Doctoral Research

Dairy cattle and buffalo Production

- ❖ Pre and postpartum management of dairy animals
- ❖ Reducing age at first calving
- ❖ Reducing calf mortality
- ❖ Reducing calving intervals
- ❖ Increasing reproductive efficiency
- ❖ Farming system research / extension approach
- ❖ System approach to livestock development
- ❖ Housing management of animals in semi arid region

Poultry Production

- ❖ Poultry housing system
- ❖ Stocking density in poultry
- ❖ Environmental effects on poultry
- ❖ Feeding management of poultry
- ❖ Methods of processing poultry manure
- ❖ System of approach for poultry development

Small ruminant production

- ❖ Sheep and goat housing system
- ❖ Impact study on scientific management of sheep and goat
- ❖ Environmental effects on sheep and goat
- ❖ Feeding management of sheep and goat

Rabbit production

- ❖ Rabbit housing system
- ❖ Feeding management of rabbit
- ❖ Productive and reproductive performance of rabbit under tropical climate

Swine production

- ❖ Swine housing system
- ❖ Feeding management of swine
- ❖ Productive and reproductive performance of pigs under tropical climate

LIVESTOCK PRODUCTS TECHNOLOGY
Course Structure - at a Glance

CODE	COURSE TITLE	CREDITS
LPT 601	FRESH MEAT TECHNOLOGY	1+1
LPT 602	MEAT PROCESSING, PACKAGING, QUALITY CONTROL AND MARKETING	2+1
LPT 603	POULTRY AND FISH PRODUCTS TECHNOLOGY	2+1
LPT 604	EGG AND EGG PRODUCTS TECHNOLOGY	1+1
LPT 605	ABATTOIR AND POULTRY PROCESSING PLANT PRACTICES	1+1
LPT 606	SLAUGHTER HOUSE BYPRODUCTS TECHNOLOGY	2+1
LPT 607	PROCESSING AND MARKETING OF WOOL	2+1
LPT 608*	MARKET MILK PROCESSING AND DAIRY PLANT PRACTICES	2+1
LPT 609	QUALITY CONTROL OF MILK AND MILK PRODUCTS	1+1
LPT 610	TECHNOLOGY OF MILK PRODUCTS	2+1
LPT 611	BIOTECHNOLOGY OF FOODS OF ANIMAL ORIGIN	1+1
LPT 612*	IN-PLANT TRAINING (NON CREDIT)	0+2
LPT 691	MASTER'S SEMINAR	1+0
LPT 699	MASTER'S RESEARCH	20
LPT 701	ADVANCES IN ABATTOIR PRACTICES AND ANIMAL BYPRODUCTS UTILIZATION	2+1
LPT 702	ADVANCES IN FRESH AND PROCESSED MEAT PRODUCTS TECHNOLOGY	3+1
LPT 703	ADVANCES IN POULTRY PRODUCTS TECHNOLOGY	2+1
LPT 704	ADVANCES IN MILK AND MILK PRODUCTS TECHNOLOGY	3+1
LPT 705	ADVANCES IN QUALITY CONTROL OF LIVESTOCK PRODUCTS	2+0
LPT 706	BIOTECHNOLOGICAL TECHNIQUES AND PROCESSES IN ANIMAL PRODUCTS	1+1
LPT 791	DOCTORAL SEMINAR I	1+0
LPT 792	DOCTORAL SEMINAR II	1+0
LPT 799	DOCTORAL RESEARCH	45

* Non-Credit (Satisfactory/Unsatisfactory)

LIVESTOCK PRODUCTS TECHNOLOGY

Course Contents

LPT 601 **FRESH MEAT TECHNOLOGY** **1+1**

Objective

To impart knowledge about history, current status of meat industry, muscle composition, functions and sensory quality of meat. To educate on factors influencing quality of meat and nutritive value.

Theory

UNIT I

History and development of meat science and meat industry, current trends and prospects of meat industry-Structure and chemistry of animal tissues, muscle functions and postmortem changes- Rigor mortis – Effect of transport on meat quality – its veterinary and clinical importance – PSE and DFD in meat quality – Conversion of muscle to meat.

UNIT II

Composition, nutritional content and general quality characterization and evaluation of meat and its products- meat microbiology –Factors affecting quality of meat – Essential nutrients in meat and poultry meat – Tenderization. Chemical residues in meat and their effects on the health of the consumer.

Practical

Microbiological sampling and evaluation of meat. Evaluation of physico-chemical and sensory properties of meat and meat products. Estimation of pH – Colour - Water holding capacity – ERV – Tyrosine value – Thiobarbituric acid number – Estimation of texture profile of meat – Estimation of glycogen, R-value, myoglobin, proximate analysis of meat and meat products including poultry products – Estimation of drip loss - Determination of Sarcomere length, fibre diameter and myofibrillar fragmentation index. Retail and wholesale cuts.

Suggested Readings

- Gracey JF. 1999. *Thornton's Meat hygiene*. 10th Ed. WB Saunders.
- Kerry J, Kerry J & Ledward D. 2005. *Meat Processing-Improving Quality*. Woodhead Publishing Ltd., UK.
- Pearson AM & Dutson TR. 1999. *Advances in Meat Research*. Vol. IX. *Quality Attributes and their Measurement in Meat, Poultry and Fish Products*. Aspen Publishers, Inc, Maryland, USA.
- Swatland H & Compbell T. 2004. *Meat Cuts and Muscle Foods*. Nottingham Univ. Press.

LPT 602 **MEAT PROCESSING, PACKAGING, QUALITY** **2+1**
CONTROL AND MARKETING

Objective

To impart knowledge on preservations, methods, product development, quality control and packaging practices in meat.

Theory

UNIT I

Factors affecting fresh meat quality, ageing, basic principles of preservation, chilling, freezing, thermal processing, dehydration, irradiation and use of chemicals and antibiotics; meat curing and smoking.

UNIT II

Comminuted meat; preparation of various kinds of fresh and cooked meat products-Canning – Heat processing – Sausages – Ham, Bacon, Tandoori-Barbecueing of Poultry.Senses of taste and olfaction-factors influencing sensory measurements, physical and chemical properties related to sensory evaluation, types of sensory panels, discriminate and descriptive testing.

UNIT III

Meat adulteration and substitution – Different techniques for meat speciation – Agar gel immuno diffusion techniques – Démonstration of CIE, IEF, ELISA, PCR

UNIT IV

Principles of packaging- Product characteristics affecting packaging requirements; packaging material and their characteristics - different methods of packaging meat – Vacuum packaging – MAP – Retort pouch processing.

UNIT V

Marketing of meat, setting up of a meat retailing unit and other meat merchandising practices. MFPO, BIS Standards for meat products.National and international specifications and standards.

Practical

Proximate composition of meat, tyrosine value, nitrite content, TBARS value, peroxide value, Formulation of different meat products, emulsion stability, shear force value, cooking determinants, subjective and objective method of sensory evaluations.

Suggested Readings

- Kerry J, Kerry J & Ledward D. 2005. *Meat Processing-Improving Quality*. Woodhead Publishing Ltd., UK.
- Pearson AM & Dutson TR. 1999. *Advances in Meat Research*. Vol. IX. *Quality Attributes and their Measurement in Meat, Poultry and Fish Products*. Aspen Publishers, Inc, Maryland, USA.
- Swatland H & Compbell T. 2004. *Meat Cuts and Muscle Foods*. Nottingham Univ. Press.

LPT 603

POULTRY AND FISH PRODUCTS TECHNOLOGY

2+1

Objective

To impart knowledge on structure, functional quality, microbiology, processing and preservation of poultry meat, eggs and fish.

Theory

UNIT I

History and development of poultry meat and egg processing industry. Different species of poultry and their production potentials- commonly occurring anti nutrients, and antibiotics in poultry feed ingredients and its

effect on egg and meat nutrition - Quality identification, quality maintenance, chemical, nutritional and microbiological quality of poultry meat. Preservation and packing techniques of shelled and liquid eggs. Quality identification of shell eggs and factors influencing the quality

UNIT II

Pre-slaughter care, transportation, resting, fasting, ante-mortem examination, methods of slaughter and slaughtering procedure-postmortem inspection-reasons for condemnation of carcass-yield and grading of dressed chicken, cut-up parts and de boned meat.

UNIT III
Structure, nutritive value, compositional chemistry, microbiology and functional properties of eggs. Low cholesterol eggs, GMP, HACCP procedures for food safety – Codex regulation for food products safety – WTO/GOI regulations for import and export of poultry products. National and international regulations, standards, quality control and marketing of fish and fish products, utilization of fish processing waste.

UNIT IV

Fishery resources, marine and fresh water fishes, transportation, processing, preservation, grading, standards. Quality control, labeling and marketing of fish and fish products, utilization of fish processing waste.

UNIT V

Post processing value added meat for export- Integration, poultry and fish processing and marketing-Storage, packaging and chilling, freezing, dehydration, canning, irradiation, curing, smoking, barbecuing, cooking and preparation of further processed poultry and fish products.

Practical

Organization, sanitation and maintenance of poultry processing plants. Slaughtering, ante-mortem and postmortem inspection, meat cutting, grading, production of ready to eat, smoked and cured poultry meat. Comminuted and other poultry based convenient items. Visit to poultry processing plant/egg processing plant. Postmortem inspection, carcass yield and grading. Meat bone ratio, quality maintenance, tenderization water holding capacity. TBA values and preparation of further processed and freeze dried poultry products. Whole egg powder, shell meal processing plant waste meal-HACCP-egg powder processing plant. Grading of shelled eggs, liquid eggs, egg powder foaming property, pasteurization of liquid egg, testing microbial load in different foams of egg, visit of egg powder plant/egg processing plant poultry and fish products and its Proximate analysis, microbiological and sensory evaluation and poultry meat and fish.

Suggested Readings

Mead GC. 1989. *Processing of Poultry*. Elsevier.

Mountney GJ. *Poultry Products Technology*. 2nd Ed. AVI Publ.

Pearson AM & Gillett TA. 1996. *Processed Meats*. 3rd Ed. Chapman & Hall.

Stadelman W & Cotterill OJ. 2002. *Eggs Science and Technology*. 4th Ed. CBS.

Suzuki T. 1981. *Fish and Krill: Protein Processing Technology*. Applied Science Publ.

LPT 604 EGG AND EGG PRODUCTS TECHNOLOGY

1+1

Objective

To impart knowledge about composition and marketing of eggs and nutritive value of eggs, preservation methods –quality maintenance, functional and value added egg product development, packaging and standards

Theory

UNIT I

Preservation and maintenance of quality of eggs- spoilage of egg and its prevention.-Preparation of fast foods.

UNIT II

Egg breaking plant lay out and organization- freezing- pasteurization- desugarisation-dehydration – quality estimation.

UNIT III

Principles involved in preparation of egg powder and other egg products- Development of convenient egg based products- packaging of egg and egg products.

UNIT IV

Specifications, standards and marketing of egg and egg products-Quality control of egg products.

Practical

Evaluation of physical, chemical, functional and microbial quality of egg and egg products. Preservation of eggs- Preparation of dehydrated and convenient egg products- Visit to egg processing plant.

Suggested Readings

Romanoff AL & Romanoff AJ. 1949. *Avian Egg*. John Wiley & Sons.

Stadelman WL & Cotterill OJ. 2002. *Egg Science and Technology*. 4th Ed. CBS.

LPT 605 ABATTOIR AND POULTRY PROCESSING PLANT PRACTICES 1+1

Objective

Teaching about abattoir design, sanitation and basic slaughterhouse practices, effluent treatment and proper disposal of wastes.

Theory

UNIT I

Layout, designing – operation and maintenance of slaughter houses and processing plants-disposal of slaughter house effluents and different designs of effluent treatment plants - equipments, organization and Slaughter house, maintenance, record keeping and operation-sanitation of slaughterhouse-Sanitary practices in meat plant and its benefits; quality control.

UNIT II

Pre-slaughter judging, inspection, grading, pre-slaughter care, slaughter of meat animals; Humane slaughter – Principles and methods of stunning – Ritual slaughter of food animals and poultry – Machineries for slaughter and dressing- processing of different kinds of meat animals- Ante-mortem inspection and Post-mortem examination of animals. Disposal and

condemnation of unfit materials.

UNIT III

Carcass quality appraisal, judgement and their grading, meat cutting, measuring yields. Application of HACCP, GMP, ISO 9000, ISO 14000, ISO 22000, BIS Standards and any recent standards for meat and processing industries

Practical

Visit to slaughterhouse– Plan and outlay of modern abattoir- Procedure for slaughter of food animals and poultry - Ante-mortem and postmortem inspection, slaughtering, grading and meat cutting, carcass yield, meat bone ratio measurement of effluent characteristics: pH, BOD, COD, suspended solids etc.

Suggested Readings

Gerrard F. 1977. *Meat Technology*. Northwood.

Gracey JF. 1999. *Thornton's Meat hygiene*. 10th Ed. WB Saunders.

LPT 606 SLAUGHTER HOUSE BYPRODUCTS TECHNOLOGY 2+1

Objective

To Impart knowledge on animal by-products, processing and industrial utilization.

Theory

UNIT I

Slaughterhouse byproducts industry in India and abroad – Importance of utilizing slaughterhouse offals – Rendering- Planning a by-product plant - Utilization of blood, bones, hooves, glands, intestines, feathers, glandular by-products and other minor by-products for industrial exploitation.

UNIT II

Meat fat characteristics - Preservation and Processing of ruminal contents – Ensiling of ruminal contents – Value products preparation from slaughterhouse by-products. processing of animal byproducts for pet foods.

UNIT III

Flaying - Classification and factors affecting quality of hides and skin- Physical and chemical characteristics of hide and skin- Processing of hide and skin for manufacture of leather- Preparation and quality control of gelatin and glue. Microscopic, physical and chemical characteristics of leather; testing and marketing of leather- Preservation and packaging practices of various kinds of hides and skin.

UNIT IV

Designing of animal byproduct plant. Collection and scope for further utilization of slaughter house byproducts. Waste treatment and pollution control- Environmental Audits-Regulations on pollution control.

Practical

Identification of quality defects in leather- preparation of sausage casing- blood meal, feather meal and meat meal. Demonstration of carcass meal – Meat meal – Bone meal - Preparation of animal casings – Grading of casings and wool – Preparation of slime meal – Collection and preservation of

glandular products – Preparation of pet foods - Visit to local by-products, processing units. Quality evaluation of rendered animal fat.

Suggested Readings

- Dilon M & Griffith C. 2001. *Auditing in the Food Industry - From Safety and Quality to Environmental and other Audits*. Woodhead Publ. Ltd.,UK.
GregoryNG. 1988. *Animal Welfare and Meat Science*. CABI.
Ockerman HW & Hansen CL. 2000. *Animal by-product processing and utilization*. Technomic Publ. Co. Ltd., Pennsylvania, USA.
Ockerman HW & Hansen CL. 2002. *Animal Byproducts Processing and Utilization*. CRC.

LPT 607 PROCESSING AND MARKETING OF WOOL 2+1

Objective

To impart knowledge on grading, manufacturing process, marketing and specifications of wool and specialty fibers- growth and structure of wool and fiber, their use.

Theory

UNIT I

Status and prospects of wool -Grading of wool. Faults and impurities in wool and their removal.

UNIT II

Wool types and their uses. Growth and molecular structure of wool fibre; physical and chemical properties of wool. Characteristics of hair fibres and their use, factors influencing quality of wool and hair fibres - Principles and steps involved in manufacturing processes of wool- specialty hair fibres.

UNIT III

Physical and chemical testing of wool. Proclaimed wool and secondary raw material - Marketing of wool, specification and regulation for quality control.

Practical

Visit to wool industry and acquaintance with various steps of manufacturing wool and its quality control, physical and chemical testing of wool. Characterization of wool, grading of wool.

Suggested Readings

- Bergen WV. 1963. *Wool Hand Book*. Vols. I, II. InterScience.

LPT 608 MARKET MILK PROCESSING AND DAIRY 2+1
PLANT PRACTICES

Objective

To impart knowledge about milk composition, legislation, milk processing techniques, cleaning and sanitation of dairy equipments.

Theory

UNIT I

Milk standards and legislation and related agencies.

UNIT II

Composition of milk, major and minor constituents of milk, physico-chemical, microbial and nutritional properties of milk and preservation of raw milk.

UNIT III

Layout Designing and organization of dairy plant, Milk procurement, handling and transportation. Chilling, centrifugation, separation, clarification, bacto-fugation and homogenization. Thermal processing- pasteurization, UHT processing, sterilization, bacto-therm and packaging, Storage and distribution of processed milk. Fortified, reconstituted and mild floured milks.

UNIT IV

Membrane processing and related techniques; application of ultrafiltration, reverse osmosis; nanofiltration and microfiltration in the dairy industry.

UNIT V

Current trends in cleaning and sanitization of dairy equipment, biological detergents, ultrasonic techniques in cleaning; biodegents. Disposal of dairy effluents.

Practical

Platform tests. Determination of fat, SNF, TS, protein, lactose and ash contents of milk. Standardization, pasteurization and sterilization. HCT profile of milk systems. Judging of different types of milks. Layout plan of market milk plant.

Suggested Readings

- Walstra P, Wouters JTM & Geurts TJ. 2006. *Dairy Science and Technology*. 2nd Ed. Taylor & Francis.
- Web BH, Johnson AH & Alford JA. 1987. *Fundamental of Dairy Chemistry*. 3rd Ed. Westport AVI Publ.

LPT 609 QUALITY CONTROL OF MILK AND MILK PRODUCTS 1+1

Objective

To impart knowledge about quality control, TQM, HACCP, SPS, CAC and legal standards.

Theory

UNIT I

Importance of quality control in dairy industry. PFA Act, BIS standards, AgMark standards and ISO standards of milk products.

UNIT II

Total quality management in processing of milk products – HACCP and SPS.

UNIT III

Types of microorganisms associated with milk and milk products-Milk borne diseases.

UNIT IV

Physico-chemical and microbial changes during procurement, processing and storage of milk and milk products.

UNIT V

Fundamental rules for sensory evaluation, Hedonic scale, score cards and their use for grading of milk and milk products.

Practical

Determination of pH and acidity, electrical conductivity, viscosity, phosphatase test, MBRT, Resazurin test, DMC, SPC. Analysis of milk and milk products in reference to BIS/PFA standards. Grading of milk and milk products.

Suggested Readings

Jennes R & Patton S. 1969. *Principles of Dairy Chemistry*. Wiley Eastern.
Yadav JS, Grover S & Batish VK. 1993. *Comprehensive Dairy Microbiology*. Metropolitan Publ.

LPT 610

TECHNOLOGY OF MILK PRODUCTS

2+1

Objective

To impart knowledge about techniques for preparation of different milk products.

Theory

UNIT I

Drying of milk and milk products; freeze dehydration, water activity; sorption behaviour of foods- dried ice cream mix – cream and butter powder.

UNIT II

Hurdle technology and its application in development of dairy products.

UNIT III

Manufacture of milk products; butter, evaporated milk, condensed milk, milk powders, ice cream and other frozen desserts. Manufacture of yoghurt-acidophilus milk-bulgaricus milk- kumiss-kefir. Manufacture of cheddar-mozzarella- cottage and processed cheese. Manufacturing of indigenous milk products- paneer- channa- khoa- ghee- dahi and shrikhand.

UNIT IV

Manufacturing of casein- caseinate- co-precipitates- Whey protein concentrate (WPC) - lactose- dairy whiteners; functional properties of whey proteins- casein- co-precipitates- Ultra Filtration retentate and their modifications.

UNIT V

Evaluation of functional properties. Packing, storage and marketing of milk products. Defects in milk products, their preventions and remedies.

Practical

Preparation of butter- paneer- channa- ghee- ice cream- cheese-cheddar-Mozzarella and cottage cheese- khoa- dahi- yoghurt- casein- caseinate-coprecipitate- determination of degree of browning chemical/physical methods; measurement of different functional properties of different milk products.

Suggested Readings

Aneja RP, Mathur BN, Banerjee AK & Chandan RC. 2002. *Technology of Indian Milk Products*. Dairy India.
Spreer E. 1993. *Milk and Dairy Products*. Marcel Dekker.

Walstra P, Wouters JTM & Geurts TJ. 2006. *Dairy Science and Technology*. 2nd Ed. Taylor & Francis.

LPT 611 BIOTECHNOLOGY OF FOODS OF ANIMAL ORIGIN 1+1

Objective

To impart knowledge about new techniques of biotechnology for improving food value.

Theory

Role of Biotechnology in productivity of livestock, Meat Speciation and quality control. Use of Biotechnology in production of food additive. Use of biotechnological tools for the processing and preservation and foods of animal origin, use of biotechnology improved enzymes in food processing industry, consumer concerns about risks and values, biotechnology and food safety. Future of food biotechnology in India.

Practical

Introduction of basic biotechnological techniques such as western blotting, enzyme isolation and identification, DNA extraction, amplification, different types of PCR, Acquaintance with RT-PCR, Multiplex PCR, gene identification and characterization.

Suggested Readings

Selected articles from journals.

LPT 612 IN-PLANT TRAINING 0+2
(Non Credit: Satisfactory/Unsatisfactory)

Objective

To impart industrial exposure to post graduate students in meat, milk, poultry and fish industry.

Practical

APT students will undergo in-plant training in any one of the specialized area of Animal Products Technology for a period of three weeks in an institute in private/public sector industry. After completion of the training, the student will submit a training report. Evaluation will be based on viva-voce examination and a report submitted by student-Preparation of Project report.

Suggested Readings

Selected articles from journals.

LPT 701 ADVANCES IN ABATTOIR PRACTICES AND ANIMAL 2+1
BYPRODUCTS UTILIZATION

Objective

To impart knowledge on advances in animal byproducts utilization such as leather, fat, casings, gelatin and abattoir effluent treatment. To expose the importance of environmental pollution and their pollutants.

Theory

UNIT I

Existing situation of slaughterhouses and processing plants in India - Collection of inedible and edible by-products for industrial uses – Disposal of

slaughterhouse effluents – Effluent treatment plant – Different designs of effluent treatment plants- Sanitary and phytosanitary measures– SSOP – Advances in chemistry and technology of leather. Latest techniques in handling, preservation, tannery procedure, manufacture and testing of leather.

UNIT II

Progress in gelatin, glue and natural casings production. Latest technology for utilization of animal byproducts, industry-waste as food, pharmaceuticals and other miscellaneous byproducts. Characterization, processing and quality control of meat fat.

UNIT III

Current trends in utilization of byproducts of egg, meat and poultry processing industry for feed, fertilizer and other useful products of economic importance- Organization, layout and operation of dry and wet rendering plants-Latest trends in disposal of slaughterhouse effluents and control of environmental pollution.

Practical

Visit to various slaughterhouses and meat processing plants – Plan and outlay of various components of modern abattoir – Designs of ETP - - Estimation of BOD and COD from abattoir effluents - Ante-mortem inspection of food animals – Methods of stunning – Stunning instruments – Electrical stunning – Slaughter and dressing of food animals – Post mortem inspection of carcasses of food animals – Fabrication of carcasses of food animals.

Suggested Readings

Gracey JF. 1999. *Thornton's Meat Hygiene*. 10th Ed. WB Saunders.

Selected articles from journals.

Wilson W. 2005. *Wilson's Practical Meat Inspection*. 7th Ed. Blackwell Publ.

LPT 702 ADVANCES IN FRESH MEAT AND PROCESSED MEAT 3+1 PRODUCTS TECHNOLOGY

Objective

To empower students on recent advances in processing, preservation, quality control, packaging, regulations and standards of meat. To bring out knowledge on harmful residues in meat and to impart information on meat species identification.

Theory

UNIT I

Development of muscular tissue – Abnormal growth and developments in muscle – Genetic nutritional and physiological aspects – Muscle proteins – Myofibrillar, sarcoplasmic and connective tissue proteins – Cytoskeletal proteins - Skeletal muscle fibre types – Lipid profile – Factors affecting muscle function and composition - Stress on the animal – Stress and the meat quality- Latest findings in the area of pre-slaughter care of meat animals- Keeping and Eating quality of meat – Properties of fresh meat – Odour, Colour, Water holding capacity - texture profile – Artificial tenderization – Meat in human nutrition – Essential nutrients in meat and poultry meat –

Prefabricated meat – Chemical residues in meat and their effects on the health of the consumer.

UNIT II

Principles of preservation – Methods - temperature control – Refrigeration – Chilling – Freezing – Mechanisation of chiller and freezer - Thermal processing – Canning – retort processing - Intermediate moisture meat – Moisture control – Dehydration – Freeze drying – Curing – Smoking – Direct microbial inhibition – Irradiation – Use of antibiotics and chemical preservatives – Organic acids – Recent advances in preservation of meat.

Meat adulteration and substitution – Different techniques for meat speciation - Packaging of meat and meat products-Critical assessment of ageing, chilling, freezing, smoking, curing, tenderization and irradiation techniques.

UNIT III

Basic meat processing procedure-Functional properties of tissue component in meat processing-forming processed meat products. Approaches for new product development-different equipments used for processing of meat products-Indigenous and heritage meat products-purpose of smoking-composition of smoke-method of smoking-liquid smoke preparation-Ham, bacon,sausages, patties, burger, meat loaves-various novel meat products.

UNIT IV

Fermented meat products-heat processing-restructured meat products-Reformed meat products-Effect of massaging,tumbling and flaking techniques and quality-intermediate, moisture meat-Enrobed meat products-Meat analogues and substitutes-Thermal processing of meat-Browning reaction-Enzymatic and non enzymatic-Protein changes in processed meat products-lipid changes-protein and lipid interaction-protein and carbohydrate interaction.

UNIT V

Meat additives and regulations pertaining to processed and convenient meat based products-Meat packaging and retailing practices-National and international standards, grading, specifications and quality control of meat and meat products.

Practical

Estimation of Colour - Estimation of texture profile of meat – Estimation of glycogen, Lactic acid, R-value, myoglobin, proximate analysis of meat and meat products – Estimation of hydroxy proline - Histological structure of muscle - Estimation of emulsion stability, thawing in meat and meat products– Identification of different packaging material – Agar gel immuno diffusion techniques – Demonstration of CIE, IEF, ELISA, PCR – Different methods of packaging of meat and meat products including poultry products - Visit to different cold stores.Evaluation of carcass quality,Estimation of muscle fiber diameter, Estimation of lipid profile of meat.

Organoleptic evaluation of meat-Estimation of Nitrate-Preparation of some novel meat products and studies on their shelf life-Total viable count and differential counts of meat and meat products-Visist of meat /poultry processing units.

Suggested Readings

- Kerry J, Kerry J & Ledward D. 2005. *Meat Processing-Improving Quality*. Woodhead Publ. Ltd., UK.
Selected articles from journals.
Swatland H & Compbell T. 2004. *Meat Cuts and Muscle Foods*. Nottingham Univ. Press.

LPT 703 ADVANCES IN POULTRY PRODUCTS TECHNOLOGY 2+1

Objective

Discussion on latest development in processing, preservation, quality control, packaging, regulations and standards of poultry meat.

Theory

UNIT I

Indian scenario of poultry processing industry Advances in poultry dressing, meat yield, preservation, microbiology and quality control methods. Automation in broiler farming, catching, transporting, control of shrinkage and methods of slaughter.

UNIT II

Preservation techniques, Room temperature preservation of poultry fast foods by multi hurdle technology critical evaluation of application of refrigeration, tenderization, canning, dehydration, irradiation, curing, smoking and cooking techniques in poultry processing and development of additional processed products.– Regulation of CAC and European standards of poultry meat and meat products.

UNIT III

Recent trends in packing and marketing of poultry and poultry products. Modified atmosphere packaging- Different packing materials for meat and cooked products.

UNIT IV

Policies and marketing trends in poultry meat -Regulations, specifications, standards and use of additives in poultry products.

UNIT V

Poultry product development formulation and profitability.

Practical

Cooked and uncooked meat quality standards- sensory evaluation of poultry meat- packaging material- Modified Atmosphere Packaging-Factors influencing meat quality at different freezing temperatures and thawing.

Suggested Readings

Selected articles from journals.

LPT 704 ADVANCES IN MILK AND MILK PRODUCTS TECHNOLOGY 3+1

Objective

To disseminate knowledge about production of high quality milk, preservation method, advances in processing of milk and milk products and packaging.

UNIT III

Rheology of milk products-Preservatives, antioxidants, antibiotics and pesticides residue in milk- Advances in bacteriological and physico-chemical analysis of milk and milk products

UNIT IV

Importance of quality assurance of livestock products for domestic and export trade – quality standards for meat - Effect of processing on nutritional and chemical qualities of meat products – Sensory evaluation of meat products – Physicochemical and microbiological quality assessment and standards - Economics of processing and product development.good manufacturing practices, meat hygiene regulations in relation to slaughter houses and processing plants-international regulations-State Municipal and other regulations pertaining to meat trade-Meat Food Products Order-ISO certification-Codex alimentarius-Bureau of Indian standards.

Suggested Readings

Selected articles from journals.

LPT 706

BIOTECHNOLOGICAL TECHNIQUES AND PROCESSES IN ANIMAL PRODUCTS

1+1

Objective

To impart knowledge about biotechnological techniques, methods, starter cultures and industrial application of biotechnology in meat industry.

Theory

UNIT I

Introduction, development and prospects of biotechnology in animal products, ancient and traditional food processing biotechniques.

UNIT II

Modern biotechnological methods and processes in animal products development, chemical and physical factors required for growing microbial cultures in nutritive substrate- Meat species identification- Quality control – Screening products for contaminants – Polymerase Chain Reaction (PCR) based products.

UNIT III

Basic principles of the industrial use of bio-reactions for production of biomass-upstream and downstream processing-application of micro-organisms as starter cultures in meat industry, microbial production of food ingredients.

Practical

Production, selection and purification of microbial cultures, making products using different microbial cultures, production of acidulation, buttery flavour, pigments, anti-microbial agents to improve the product quality and safety-Polymerase Chain Reaction (PCR).

Suggested Readings

Selected articles from journals.

LIVESTOCK PRODUCT TECHNOLOGY

List of Journals

- ❖ Advances in Food Research
- ❖ Beverage and Food World
- ❖ British Poultry Science
- ❖ Dairy Foods
- ❖ Dairy Indian
- ❖ Dairy Industries International
- ❖ Dairy Science Abstracts
- ❖ Flieshwirtschaft
- ❖ Food Processing
- ❖ Food Technology
- ❖ Food Technology
- ❖ Indian Dairy Man
- ❖ Indian Food Industry
- ❖ Indian Journal of Dairy Technology
- ❖ Indian Journal of Food Science and Technology
- ❖ Indian Journal of Poultry Science
- ❖ Indian Journal of Veterinary Research
- ❖ International Dairy Federation
- ❖ International Dairy Journal
- ❖ International Food Hygiene
- ❖ International Journal of Dairy Technology
- ❖ Journal of Animal Science
- ❖ Journal of Dairy Research
- ❖ Journal of Dairy Science
- ❖ Journal of Food Protection
- ❖ Journal of Food Science
- ❖ Journal of Meat Science
- ❖ Milk Industry
- ❖ Poultry Science
- ❖ Processed Food Industry
- ❖ Science of Food and Agriculture

e-Resources

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| ❖ www.meatscience.org | ❖ www.usa.gov |
| ❖ www.amis.org | ❖ www.fsis.usda.gov |
| ❖ www.meatami.com | ❖ www.poultryhelp.com |
| ❖ www.mla.org.au | ❖ www.nddb.org |
| ❖ www.FAO.org | ❖ www.ndri.res.in |
| ❖ www.agresearch.co.nz/mirinz | ❖ www.amul.com |
| | ❖ www.idfa.org |

Suggested Broad Topics for Master's and Doctoral Research

- ❖ Development of shelf stable meat products
- ❖ Development of intermediate moisture meat products
- ❖ Application of active packaging for improving shelf life
- ❖ Development of low sodium meat products
- ❖ Development of low fat meat products
- ❖ Enrichment of meat with fiber
- ❖ Enrichment of meat with calcium
- ❖ Utilization of edible byproducts
- ❖ Utilization inedible byproducts
- ❖ Prevention of oxidative rancidity in meat products
- ❖ Development in processing of poultry meat.
- ❖ Recent advances in processing of egg and egg products.
- ❖ Recent advances in preservation and quality control of egg and egg products
- ❖ Development in packaging, regulations and standards of poultry meat.
- ❖ Development in preservation and quality control of poultry meat.
- ❖ Development of functional casinates for food industry
- ❖ Development of phytoformula
- ❖ Development of geriatric biofoods
- ❖ Development of hydrolysed lactose milk drinks to lactose intolerants
- ❖ Membrane utilization in indigenous dairy products

POULTRY SCIENCE
Course Structure - at a Glance

CODE	COURSE TITLE	CREDITS
PSC 601	POULTRY BREEDING AND GENETICS	2+1
PSC 602	POULTRY NUTRITION AND FEEDING	2+1
PSC 603	COMMERCIAL LAYER PRODUCTION	2+1
PSC 604	COMMERCIAL BROILER PRODUCTION	2+1
PSC 605	BREEDER STOCK, FLOCK HEALTH AND HATCHERY MANAGEMENT	3+1
PSC 606	MANAGEMENT OF POULTRY OTHER THAN CHICKEN	2+1
PSC 607	POULTRY PRODUCTS TECHNOLOGY AND MARKETING	2+1
PSC 608	POULTRY ECONOMICS , PROJECTS AND MARKETING	2+1
PSC 609	PHYSIOLOGY OF POULTRY PRODUCTION	2+1
PSC 691	MASTER'S SEMINAR	1+0
PSC 699	MASTER'S RESEARCH	20
PSC 701	APPLIED POULTRY NUTRITION	2+1
PSC 702	CONCEPTS IN COMMERCIAL POULTRY PRODUCTION	2+1
PSC 703	DEVELOPMENTS IN POULTRY PRODUCTS TECHNOLOGY	2+1
PSC 704	EMERGING DISEASES OF POULTRY AND FLOCK HEALTH	2+1
PSC 705	ADVANCED POULTRY BREEDING METHODS	2+1
PSC 706	POULTRY ECONOMICS, MARKETING AND INTEGRATION	2+1
PSC 791	DOCTORAL SEMINAR I	1+0
PSC 792	DOCTORAL SEMINAR II	1+0
PSC 799	DOCTORAL RESEARCH	45

POULTRY SCIENCE

Course Contents

PSC 601 POULTRY BREEDING AND GENETICS 2+1

Objective

To impart knowledge on different systems of breeding, selection methods, design and implementation of breeding programme in developing egg-type and meat type birds. Modern tools in poultry breeding.

Theory

UNIT I

Genetic classification of Poultry –Origin and breed characteristics of poultry-Development of Poultry Industry in India - Mendel's laws of inheritance related to poultry -Qualitative and Quantitative traits in Poultry breeding -Additive, Non Additive, Epistatic and complementary gene action – Lethal and mutations in poultry – Sex linked, Sex limited and Sex influenced traits – Economic traits - Heritability – Quantitative inheritance — Phenotype, Genotype & environment interactions.

UNIT II

Systems of Breeding – Systems of Mating – Selection methods – Breeding programme for developing egg-type and Broiler type of birds – Developing hybrids - Other species of Poultry breeding and management - Formation and Management of inbred, pure lines, grand parent and parent stock.

UNIT III

Industrial breeding-Artificial insemination in chicken-Autosexing-Random SampleTest. Use of molecular genetics in poultry breeding-Quantitative trait loci and marker-assisted selection-Conservation of poultry genetic resources.

Practical

Breeds of poultry – Factors affecting inheritance of qualitative and quantitative traits in poultry - Constructing index and Osborne index-Estimating heritability – Breeding program for developing commercial hybrid layers, broilers, Japanese quail, duck, turkey, fancy birds, Guinea Fowl and Pigeons – Semen collection, evaluation & insemination in chicken & turkey – Breeding records –Use of computers to maintain breeding records and for selection.

Suggested Readings

Crawford RD. 1990. *Poultry Breeding and Genetics*. Elsevier.
Singh RP & Kumar J. 1994. *Biometrical Methods in Poultry Breeding*. Kalyani.

PSC 602 POULTRY NUTRITION AND FEEDING 2+1

Objective

Teaching about nutrients & their functions, nutrient requirements of poultry and factors influencing the same. Imparting knowledge of different types of feeds and feeding methods.

Theory

UNIT I

Digestive system, digestion, metabolism and absorption of feed in poultry – Factors influencing the feed consumption in birds – Macro and micro-nutrients – Nutrient requirements for various species of poultry. Partitioning of energy -

Calorie: protein ratio – Nutrient interrelationships – Factors influencing the nutrient requirements.

UNIT II

Feed ingredients composition, feed storage technique-milling and quality control- Processing of feed – Types & forms of feeds and feeding methods - Commonly occurring anti nutrients and toxicants in poultry feed ingredients – Mycotoxins and their prevention – Feeding chicks, growers, layers, broilers and breeders – Principles of computing feed- – Balanced feeds -Least cost feed formulation and programming – Feeding in different seasons and stress conditions - Nutritional and metabolic disorders in poultry.

UNIT III

Systems of feeding – restricted, forced, controlled and phase feeding -Use of Additives and Non additives- enzymes, probiotics, prebiotics antibiotics, herbs, performance enhancers – Utilization of non-conventional feedstuff - Feeding of ducks, turkeys, Japanese quails, Guinea fowls.

UNIT IV

Organic, functional, designer & SPF feed production - Production of drug residue, pesticide residue & toxin free feeds – regulations for Import and Export of feed and feed supplements.

Practical

Physical and sensory evaluation of feed ingredients- sampling techniques for ingredients and compounded feed-Estimation of proximate principles of feed and feed ingredients – Computing various poultry feed formulae based on commonly available feed ingredients – Estimation of Aflatoxin, Calcium, Phosphorus, Sand, Silica and Salt – Mash, pellet & crumble feed preparation – Feeding procedures. Visit to feed mills – Preparation of Project report for a feed mill–Hands on Training in feed analytical lab- Preparation & quality control of organic and designer feeds.

Suggested Readings

- Einsminger ME. 1992. *Poultry Science*. Poultry International Book Distributing Co.
- Mac O' North & Bell D. 1990. *Commercial Chicken Production Manual*. 4th Ed. Avi Publ. Co. Inc., Westport, Connecticut.
- Singh RA & Panda B.1992. *Poultry Production*. Kalyani Publishers.

PSC 603

COMMERCIAL LAYER PRODUCTION

2+1

Objective

To impart knowledge on different systems of rearing commercial egg laying birds, care and management of commercial layers for optimal egg production.

Theory

UNIT I

Layer Industry in India and the World – Systems of layer farming – Location – Lay out of the farm – Systems of housing – Types of roofs, roof materials, pillars, trusses for poultry houses – Design of different Poultry Houses for large & medium size layer farms – Cages & modified cages for egg type birds – Layer

farm equipments –Automation in poultry houses and its maintenance – Management of layers in different systems of rearing.

UNIT II

Deep litter & cage system of management – Medication and vaccination schedules & procedure for layers – Lighting programme for egg type birds - Water quality standards, watering of layer and water sanitation – Brooder, grower and layer management – All in All out and Multiple batch system of rearing layers.

UNIT III

Management of layers during peak egg production and maintaining the persistency in production–Factors causing uneven growth and low egg production -Monitoring egg production curve.

UNIT IV

Culling of unproductive birds – Record keeping – Biosecurity & health management – Management during different seasons – Induced moulting.- HACCP application for safe egg, value added egg production – Production of eggs free from harmful microbes, Mycotoxins & drug residues- Integration in layer production.

Practical

Layer farm lay out and blue print– Design of different chick, grower & layer houses, their specifications & blue print of deep litter and cage system– Selection & culling of layers, debeaking, dubbing, deworming, delicing, vaccination & other farm routines and operations – Farm sanitation, disinfection & waste disposal – Maintaining farm records – Visit to commercial layer farms – Record keeping – Calculating Hen day egg production, Hen housed egg production and other economic traits – Case study of production loss, reasons and corrective measures – Preparing project reports for layers under different batch systems – Calculating the cost of production of eggs.

Suggested Readings

Mac O' North & Bell D. 1990. *Commercial Chicken Production Manual*. 4th Ed. Avi Publ. Co. Inc., Westport, Connecticut.

PSC 604

COMMERCIAL BROILER PRODUCTION

2+1

Objective

To deal with different systems of rearing commercial broilers, manage mental practices for higher bodyweight with best feed efficiency in commercial broilers. Marketing of broilers efficiently.

Theory

UNIT I

Broiler Industry in India and the World – Systems of rearing broilers – Location, layout and design of Broiler houses – Broiler farm equipment.

UNIT II

Brooding and rearing of broilers- All in all out and multiple batch systems – Litter materials and deep litter management – Lighting for broilers – Environmentally controlled broiler houses & their management – Water quality and Watering of broiler and water sanitation- Management during different seasons.

UNIT III

Mash, crumble and pellet feeding of Broilers – weekly growth rate, feed conversion and livability in broilers- sex separate feeding – Feeding broilers for optimum growth rate & feed efficiency- Broiler performance indices – Broiler farm records.

UNIT IV

Broiler farm routine, medication and vaccination schedule – Bio-security and health management and their control – Systems of Integration in broiler production and marketing –transport of broilers– Different ways of marketing of broilers- Regulations and specifications for production of export quality broilers – Organic broiler meat production.

Practical

Location and blue print for a broiler farm – Broiler house design – Preparation of project report for broiler farm – Visit to broiler farms – Judging of live broilers and ready-to-cook broilers– Broiler vaccination, medication, brooding and transportation and farm routines. Record keeping - Calculating the cost of production of broilers – Feeding of broilers at different ages – Working out Feed efficiency – Case study on low body weights, reasons and corrective measures.

Suggested Readings

Mac O' North & Bell D. 1990. *Commercial Chicken Production Manual*. 4th Ed. Avi Publ. Co. Inc., Westport, Connecticut.

PSC 605

BREEDER STOCK, FLOCK HEALTH AND HATCHERY MANAGEMENT 3+1

Objective

To impart knowledge about care and management of breeders, hatchery operation, health management. And to study about common diseases and disorders of poultry, diagnosis, vaccination, prevention, control and treatment. Bio security measures in control of general & hatchery borne diseases.

Theory

UNIT I

History of Natural and Artificial incubation- embryo development-different breeder flocks – Planning a hatchery, breeder farm – Special care of breeder flock –Collection, selection and care of hatching eggs – Breeder male and female management – Flock testing & culling - Farm and hatchery equipments – Incubation practices – Ventilation and temperature control – Hatchery Management, Fumigation and sanitation – Breeder farm and hatchery operations, routine & schedule - Factors affecting fertility and hatchability.

UNIT II

Care of day old chicks and their vaccination - Restricted & controlled feeding of breeders – Sex separate feeding and nutrient supplementation. – Seasonal management of breeders – Location of hatchery – Layout and design of breeder houses, hatchery & other buildings.

UNIT III

Biosecurity, health management and waste disposal – Vaccination & medication schedule for breeders. Control of vertically transmissible & hatchery borne diseases.

UNIT IV

Principles of bio security- Farm sanitation and disinfection procedures-Common bacterial diseases- Salmonella, Pasteurella, E.coli, Fowl typhoid, CRD, Infectious Coryza, Viral diseases-Newcastle, Infectious bronchitis, Infectious laryngo tracheitis, Mareks, Fowl pox, Infectious Bursal disease, Egg drop syndrome-76, Avian Encephalomyelitis, Avian influenza, Duck viral Enteritis, Duck viral hepatitis-Fungal diseases- Aspergillosis, Mycotoxicosis, Metabolic disorders-Fatty liver haemorrhagic syndrome(FLHS), Gout and Ascites, Protozoan diseases-Coccidiosis, Ecto and endo parasitic infestation of poultry. Diagnosis, vaccination, prevention, treatment and control – Locational, structural & operational biosecurity in Poultry farms – Water sanitation & control of water borne diseases – Quarantine of poultry. Packaging and transportation of hatching eggs and chicks.

UNIT V

Hatching egg & SPF egg import and export regulations – Maintaining Salmonella and Mycoplasma free breeding flock –Application of HACCP and Good Management Practices (GMP) in hatchery management for better chick quality.

Practical

Breeder farms and hatchery records, selection, fumigation, care and storage of hatching eggs. Layout and blue prints for breeder farm and hatchery –Incubation requirements –Incubator management – Hatchery sanitation & fumigation procedures – Pedigree hatching – Hatchery waste disposal and recycling – Calculating cost of production of hatching eggs and day-old-chicks – Attending breeder farm routines & operation – Flock testing & culling of reactors – Analyzing hatchability results and hatchery records-Economics of layer and broiler hatchery.

Suggested Readings

Crawford.RD. 1993. (Ed.). *Poultry Breeding and Genetics*. Elsevier.

Mac O' North & Bell D. 1990. *Commercial Chicken Production Manual*. 4th Ed. Avi Publ. Co. Inc., Westport, Connecticut.

PSC 606

MANAGEMENT OF POULTRY OTHER THAN CHICKEN 2+1

Objective

Care and management of different breeds, varieties of poultry other than chicken, methods of rearing and common diseases affecting them and their control measure.

Theory

UNIT I

Breeds and varieties of Turkey, Duck, Goose, Pigeon, Guinea fowl, Budgerigar, Japanese quail, Emu and Ostrich – Incubation periods & incubation procedure for different species – Housing, cage & equipments for different species – Duck, Turkey, Japanese Quail, Guinea fowl, Emu, Ostrich production and rearing under different systems.

UNIT II

Management and rearing of Turkey, duck, goose, Guinea fowl, Japanese quail, pigeon, emu and ostrich- Feeding standards and feeding, watering and rearing

systems and procedure for different species of poultry- Breeding policies of egg and meat production in different species – Preparation of Project reports for different species for commercial exploitation.

UNIT III

Common diseases affecting poultry other than chicken and their control – Regulations for import and export of different species of poultry – prevention of exotic diseases through import of poultry products and live birds.

Practical

Layout and design of housing & cages for other species of poultry. Visit to commercial Japanese quail, turkey and duck farms. Incubation and care of hatching eggs and young ones – Rearing practices followed by duck, quails and turkey farmers under field conditions. Preparing project reports for different species and calculating the cost of production.

Suggested Readings

Einsminger ME. 1992. *Poultry Science*. Poultry International Book Distr. Co.

PSC 607

POULTRY PRODUCTS TECHNOLOGY AND MARKETING

2+1

Objective

Composition and nutritive value of eggs and chicken meat, grading and preservation methods of eggs and meat, functional and value added poultry products, marketing of eggs and poultry meat.

Theory

UNIT I

Physical and chemical composition and nutritive value of eggs and meat – Grading of eggs & meat by different standards –Preservation of eggs - Egg quality deterioration - Factors affecting egg quality – Handling, processing, packaging materials, packaging, transport and marketing of eggs.

UNIT II

Quality control of poultry meat – Quality preservation – Marketing of egg and poultry meat – Marketing channels – Integration in poultry processing and marketing-Functional and value added eggs and meat – Further processing of eggs and meat – Various egg and meat fast foods.

UNIT III

Sanitary and phyto sanitary measures to ensure food safety – Post oviposition value addition to the eggs & Post processing value addition to the meat for export – Production of low cholesterol eggs – Microbial safety of poultry products – Import and export of poultry products – Further processing of poultry for export – Implementation of GMP and HACCP procedures for food safety – Codex regulations for poultry products safety.

Practical

Measuring internal and external egg qualities – Preservation of table eggs, grading of eggs – Processing of chicken – Further processing of poultry – Preservation of poultry meat – Preparation of various eggs and poultry meat products and fast foods – Preservation, packaging and transport – Quality control of value added poultry products – Estimation of pesticides, antibiotics and mycotoxin residues in eggs and meat – Measures of microbial safety of poultry products for export.

Artificial insemination-Semen extenders-reproductive tract-egg formation-egg laying pattern-photo periodic responses – Role of endocrine glands and their functions. Thermoregulatory mechanism – Stress due to adverse environmental factors –Acid –base balance – Poultry ethology.

UNIT III

Neuro-endocrine control of egg production-Ovulation and Oviposition – Clutch and Pause.

Practical

Demonstration of various systems of birds – structure of feather- Identification of endocrine glands –hormones in poultry production and reproduction- Haematology of poultry species - SGOT, SGPT, free fatty acids - Morphology of Poultry spermatozoa.

Suggested Readings

Rose SP.1997. *Principles of Poultry Science*. CABI.

PSC 701

APPLIED POULTRY NUTRITION

2+1

Objective

Teaching about nutrients and their functions, nutrient requirements of poultry and factors influencing the same. Different methods and forms of feeds and feeding of poultry.

Theory

UNIT I

Developments in the nutrient requirement for egg and meat-type chicken - Concepts in various poultry feeding procedures and methods for optimal production - Factors influencing the nutrient requirements, feed intake and feed efficiency in poultry-Problems encountered in nutritional deficiencies - Protein and energy utilization and calorie protein ratio, Vitamins, minerals and their interactions in poultry rations.

UNIT II

In Ovo -Juvenile nutrition for optimal growth rate and feed efficiency – Care in grower feeding - Nutrition and feeding of layers /breeders during peak egg production- Nutritional requirements for higher egg production, broiler meat production, higher fertility and hatchability and other special purposes.

UNIT III

Feeding of broilers for uniform growth rate and feed efficiency – Feeding to enhance egg quality and nutrients-Enzymes-additives-non-additives in feed production – organic, functional and designer feeds. Advances in feed milling technology – Specialty feed production to produce microbial safe foods, SPF eggs and organic foods.

UNIT IV

HACCP implementation in feed quality control – Production of drug, Mycotoxins and pesticide residue free feeds.

Practical

Computing of specialty and functional feeds – Estimation of available carbohydrate, Aflatoxin, tannins, hydro cyanic acid and other toxins in the feed. Evaluation of various feeds for its quality – Field methods of feed quality control

PSC 703

DEVELOPMENTS IN POULTRY PRODUCTS TECHNOLOGY

2+1

Objective

Composition and nutritive value of eggs and chicken meat, grading, packaging and preservation methods of eggs and meat, functional and value added poultry products, marketing of eggs and poultry meat.

Theory

UNIT I

Global trends in poultry and egg processing - Indian scenario of poultry processing industry - Nutrients & Non-nutrient components in regular and value added poultry products – various measures of egg and meat quality control – advances in value addition to poultry products.

UNIT II

Concepts in poultry meat and egg preservation – Newer concepts in meat tenderization, canning, dehydration, curing, irradiation, etc. - Modified atmosphere packaging – Other processed products - Room temperature preservation of poultry fast foods by multi hurdle technology.

UNIT III

Egg desugarization - pasteurization – Functional properties of eggs – Industrial uses of eggs – Marketing trends in poultry meat and eggs.

UNIT IV

Improving the product quality to meet Codex & European standards – Standards for egg, meat and their products -Production of immunoglobulins, lecithin, lysozyme, sialic acid and other pharmaceutical products from eggs – Sanitary & phytosanitary measures for food safety.

Practical

Preparation of value added products suitable for preservation at room temperature – Further processing – Barbecuing and Tandoori preparation – preparation of locale specific poultry meat and egg products – Meat balls, meat patties - Estimation of various egg and meat qualities – Preservation of meat and eggs - Measuring the microbial quality of poultry foods – Drug, pesticide, mycotoxin and antibiotic residue assay

Suggested Readings

Selected articles from journals.

PSC 704

EMERGING DISEASES OF POULTRY AND FLOCK HEALTH

2+1

Objective

To study about common diseases and disorders of poultry, their diagnosis, vaccination, prevention & treatment, emphasis on control of emerging poultry diseases of zoonotic importance, disease diagnostic techniques.

Theory

UNIT I

The concepts of disease prevention in poultry – Emerging and reemerging avian diseases -Factors influencing immuno suppression and stimulation – Developing immunity in poultry

UNIT II

Water sanitation, hatchery sanitation procedures - Control of vertically transmissible diseases – non-infectious and metabolic diseases in poultry and their control – Bio security – Mycotoxins and their control.

UNIT III

Stress alleviation – prevention and control of bacterial and viral diseases in poultry – Biosecurity measures – Control measures of problematic re-emerging diseases of poultry like Ranikhet, Avian influenza, Marek's disease, Infectious bursal disease, Infectious Bronchitis, Infectious laryngo tracheitis.

UNIT IV

Flock management for Specific pathogen free egg production – Maintaining the HACCP standards in poultry farms – developments in the Exim policies for flock health.

Practical

Studying the Immune status of birds – Egg inoculation techniques in laboratory diagnosis –differential diagnosis of various poultry diseases by postmortem, and laboratory techniques – Antibiotic sensitivity test – Vaccination – Disinfection and ectoparasite control, medication procedures.

Suggested Readings

Selected articles from journals.

PSC 705

ADVANCED POULTRY BREEDING METHODS

2+1

Objective

To impart knowledge about different systems of breeding, selection methods and implementation of breeding programme in developing egg-type and broiler hybrids. Modern tools in poultry breeding.

Theory

UNIT I

Gene and genotypic frequency- Sex linked, limited and influenced traits-Auto sexing- Qualitative and quantitative traits and its inheritance in poultry- methods of selection – family selection – selection for multi characteristics and construction of selection indices – restricted selection indices – indirect selection - Reciprocal recurrent selection – Recurrent selection – Random bred control populations - Selection limit - Osborne's index – construction of selection index for multiple traits – Advances in commercial poultry breeding.

UNIT II

Modern methods in commercial layer and broiler breeding, performance testing – Pure line breeding – Inbreeding and hybridization - Diallele mating, lethal and semi lethals in poultry. Pedigree hatching. Genotype versus environmental interaction.

UNIT III

Exploitation of additive and non-additive gene action for commercial poultry production - Heterosis – Exploitation of hybrid vigour for commercial production of layers and broilers- Formation of synthetic lines – Development of strains in poultry-Comparative efficiency of different selection methods in poultry.

Practical

Construction of selection index – Analysis of breeding data collected from breeding records – Problem in qualitative and quantitative inheritance- Estimation of heritability and standard error of heritability by different methods – analysis of heritability for different traits – Estimation of inbreeding coefficient – Artificial insemination in poultry.

Suggested Readings

Muir WM & Aggrey SE. 2003. Poultry Genetics and Biotechnology. CABI.
Selected articles from journals.

PSC 706 POULTRY ECONOMICS, MARKETING AND INTEGRATION 2+1**Objective**

To study about measures of performance efficiency in poultry farms and its allied sectors, hatcheries and developing poultry projects.

TheoryUNIT I

Present practices and future trends in production of egg and meat – consumption – demand and supply-seasonal variations in production and consumption. Marketing channels- procedures of marketing for eggs and meat - Market intelligence-Advertising and branding of poultry products – wholesaling and retailing – quality of eggs and meat.

UNIT II

Various poultry enterprises – choice of production size of business – input and output analysis – calculating cost of various inputs – calculating cost of production . Price determination – Least demand and supply indices of performance – Performance targets and achievements-marketing and business management-market managerial skills and human resource development-cost and financial management.

UNIT III

Future trends in broiler and egg production –factors influencing the profit margin in poultry enterprises.

Practical

Study of marketing channels of egg and meat, calculating cost of production of eggs, meat, day-old chick, feed and processing plants– preparing other related poultry projects.

Suggested Readings

Einsminger ME. 1992. *Poultry Science*. Poultry International Book Distri. Co.
Selected articles from journals.

POULTRY SCIENCE

List of Journals

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| <ul style="list-style-type: none"> ❖ Avian Diseases ❖ Avian Pathology ❖ Avian Research ❖ British Poultry Science ❖ Indian Journal of Poultry Science ❖ International Poultry Production ❖ Japanese Poultry Science ❖ Journal of Applied Poultry Research | <ul style="list-style-type: none"> ❖ Journal Avian Biology ❖ Poultry Abstract ❖ Poultry Science ❖ World Poultry Science Channel ❖ Tamilnadu Journal of Veterinary and Animal Sciences ❖ Indian Journal of Veterinary and Animal Sciences |
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e-Resources

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| <ul style="list-style-type: none"> ❖ http://www.alabamapoultry.org ❖ http://www.egg.com ❖ http://www.dpicken.com ❖ http://www.georgiaeggs.org ❖ http://www.ansc.purdue.edu/ISEB ❖ http://www.ag.ansc.purdue.edu/ISP ❖ http://www.MidwestPoultry.com ❖ http://www.MinnesotaTurkey.com ❖ http://www.nebraskapoultry.org ❖ http://www.ncegg.org ❖ http://www.ohiopoultry.org ❖ http://www.aeb.org ❖ http://www.fb.org ❖ http://www.afia.org ❖ http://www.albucusa.org ❖ http://www.amerpoultryassn.com ❖ http://www.avianresearch.co.uk ❖ http://www.canr.uconn.edu/ansci/ ❖ http://www.ansc.cornell.edu ❖ http://www.castscience.org ❖ http://www.enconline.org ❖ http://www.internationalegg.com ❖ http://www.eatchicken.com ❖ http://www.foodsafety.gov/~dms/fs-toc.html ❖ http://www.nmaonline.org ❖ http://www.eatturkey.com ❖ http://www.naga.org ❖ http://www.mtgplace.com ❖ http://www.poultryscience.org ❖ http://www.posc.tamu.edu/library/dother.html ❖ http://www.poultryegg.org ❖ http://www.usapeec.org ❖ http://www.wattpoultry.com ❖ http://www.afns.ualberta.ca ❖ http://www.poultryresearchcentre.ch ❖ http://www.poultryscience.uark.edu/poult | <ul style="list-style-type: none"> ❖ http://www.ag.auburn.edu/dept/ph/index.html ❖ http://www.aes.ucdavis.edu ❖ http://animalscience.ucdavis.edu/ ❖ http://animalscience.ucdavis.edu/extension/ ❖ http://www.calstate.edu ❖ http://www.csupomona.edu ❖ http://www.animalscience.calpoly.edu ❖ http://www.clemson.edu/avs/ |
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Suggested Broad Topics for Master's and Doctoral Research

- ❖ Breeding programs for different species of poultry to improve the economic traits.
- ❖ Utilization of conventional and unconventional feeds in poultry rations.
- ❖ Study on exogenous enzymes, probiotics for increasing the feed efficiency in poultry.
- ❖ Evolving ways and means for the improving the performance of commercial, broilers and layers for higher economic gains.
- ❖ Micro and trace minerals requirements study for broiler and layers.
- ❖ Designing and development of eco friendly and environmentally controlled houses for large commercial poultry farms.
- ❖ Standardizing the disinfections procedures for sustainable poultry production.
- ❖ Standardizing the sanitary and phyto sanitary measures for safe production of eggs and broilers.
- ❖ Prevention and control of toxin, pesticides and antibiotic residues in egg and meat.
- ❖ Value added egg and poultry meat products program
- ❖ Development of fast foods by utilizing poultry egg and meat.
- ❖ Development and standardization of designer eggs and low fat high protein poultry meat.
- ❖ Preservation, storage, packaging of value added egg and meat products and their standardization.
- ❖ Reduction of pollution from poultry farms and processing plants.
- ❖ Profitable utilization of Poultry waste and manure.
- ❖ Development and standardization of organic poultry farming and standards for phyto sanitary measures
- ❖ Standardization of managemental, nutritional methods and schedules for rearing turkeys, guinea fowls, geese, Japanese quails and domesticated ratites.
- ❖ Development of suitable varieties of turkeys and guinea fowl suitable for different agro climatic conditions.
- ❖ Development of suitable birds for backyard poultry.
- ❖ Poultry bio security measures in organized farms.
- ❖ Studies on diseases affecting turkeys, guinea fowl, Japanese quail and their preventive measures.
- ❖ Disease surveillance, forecasting and development of field level diagnostic kits.

COMPULSORY NON-CREDIT COURSES

(Compulsory for Master's programme in all disciplines; Optional for Ph.D. scholars)

CODE	COURSE TITLE	CREDITS
PGS 501	LIBRARY AND INFORMATION SERVICES	0+1
PGS 502	TECHNICAL WRITING AND COMMUNICATIONS SKILLS	0+1
PGS 503 (e-Course)	INTELLECTUAL PROPERTY AND ITS MANAGEMENT	1+0
PGS 506 (e-Course)	DISASTER MANAGEMENT	1+0

Course Contents

PGS 501 LIBRARY AND INFORMATION SERVICES 0+1

Objective

To equip the library users with skills to trace information from libraries efficiently, to apprise them of information and knowledge resources, to carry out literature survey, to formulate information search strategies, and to use modern tools (Internet, OPAC, search engines etc.) of information search.

Practical

Introduction to library and its services; Role of libraries in education, research and technology transfer; Classification systems and organization of library; Sources of information- Primary Sources, Secondary Sources and Tertiary Sources; Intricacies of abstracting and indexing services (Science Citation Index, Biological Abstracts, Chemical Abstracts, CABI Abstracts, etc.); Tracing information from reference sources; Literature survey; Citation techniques/Preparation of bibliography; Use of CD-ROM Databases, Online Public Access Catalogue and other computerized library services; Use of Internet including search engines and its resources; e-resources access methods.

PGS 502 TECHNICAL WRITING AND COMMUNICATIONS SKILLS 0+1

Objective

To equip the students/scholars with skills to write dissertations, research papers, etc.

To equip the students/scholars with skills to communicate and articulate in English (verbal as well as writing).

Practical

Technical Writing - Various forms of scientific writings- theses, technical papers, reviews, manuals, etc; Various parts of thesis and research communications (title page, authorship contents page, preface, introduction, review of literature, material and methods, experimental results and discussion); Writing of abstracts, summaries, précis, citations etc.; commonly used abbreviations in the theses and research communications; illustrations, photographs and drawings with suitable captions; pagination,

numbering of tables and illustrations; Writing of numbers and dates in scientific write-ups; Editing and proof-reading; Writing of a review article. **Communication Skills** - Grammar (Tenses, parts of speech, clauses, punctuation marks); Error analysis (Common errors); Concord; Collocation; Phonetic symbols and transcription; Accentual pattern: Weak forms in connected speech: Participation in group discussion: Facing an interview; presentation of scientific papers.

Suggested Readings

- Chicago Manual of Style*. 14th Ed. 1996. Prentice Hall of India.
Collins' Cobuild English Dictionary. 1995. Harper Collins.
 Gordon HM & Walter JA. 1970. *Technical Writing*. 3rd Ed. Holt, Rinehart & Winston.
 Hornby AS. 2000. *Comp. Oxford Advanced Learner's Dictionary of Current English*. 6th Ed. Oxford University Press.
 James HS. 1994. *Handbook for Technical Writing*. NTC Business Books.
 Joseph G. 2000. *MLA Handbook for Writers of Research Papers*. 5th Ed. Affiliated East-West Press.
 Mohan K. 2005. *Speaking English Effectively*. MacMillan India.
 Richard WS. 1969. *Technical Writing*. Barnes & Noble.
 Robert C. (Ed.). 2005. *Spoken English: Flourish Your Language*. Abhishek.
 Sethi J & Dhamija PV. 2004. *Course in Phonetics and Spoken English*. 2nd Ed. Prentice Hall of India.
 Wren PC & Martin H. 2006. *High School English Grammar and Composition*. S. Chand & Co.

PGS 503
(e-Course)

**INTELLECTUAL PROPERTY AND ITS
MANAGEMENT**

1+0

Objective

The main objective of this course is to equip students and stakeholders with knowledge of intellectual property rights (IPR) related protection systems, their significance and use of IPR as a tool for wealth and value creation in a knowledge-based economy.

Theory

Historical perspectives and need for the introduction of Intellectual Property Right regime; TRIPs and various provisions in TRIPS Agreement; Intellectual Property and Intellectual Property Rights (IPR), benefits of securing IPRs; Indian Legislations for the protection of various types of Intellectual Properties; Fundamentals of patents, copyrights, geographical indications, designs and layout, trade secrets and traditional knowledge, trademarks, protection of animal varieties and farmers' rights and bio-diversity protection; Protectable subject matters, protection in biotechnology, protection of other biological materials, ownership and period of protection; National Biodiversity protection initiatives; Convention on Biological Diversity; International Treaty on Plant Genetic Resources for Food and Agriculture; Licensing of technologies, Material transfer agreements, Research collaboration Agreement, License Agreement.

Suggested Readings

- Erbisch FH & Maredia K. 1998. *Intellectual Property Rights in Agricultural Biotechnology*. CABI.
- Ganguli P. 2001. *Intellectual Property Rights: Unleashing Knowledge Economy*. McGraw-Hill.
- Intellectual Property Rights: Key to New Wealth Generation*. 2001. NRDC & Aesthetic Technologies.
- Ministry of Agriculture, Government of India. 2004. *State of Indian Farmer*. Vol. V. *Technology Generation and IPR Issues*. Academic Foundation.
- Rothschild M & Scott N. (Ed.). 2003. *Intellectual Property Rights in Animal Breeding and Genetics*. CABI.
- Saha R. (Ed.). 2006. *Intellectual Property Rights in NAM and Other Developing Countries: A Compendium on Law and Policies*. Daya Publ. House.
- The Indian Acts - Patents Act, 1970 and amendments; Design Act, 2000; Trademarks Act, 1999; The Copyright Act, 1957 and amendments; Layout Design Act, 2000; PPV and FR Act 2001, and Rules 2003; National Biological Diversity Act, 2003.*

PGS 506
(e-Course)

DISASTER MANAGEMENT

1+0

Objectives

To introduce learners to the key concepts and practices of natural disaster management; to equip them to conduct thorough assessment of hazards, and risks vulnerability; and capacity building.

Theory

UNIT I

Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, Drought, Cyclone, Earthquakes, Landslides, Avalanches, Volcanic eruptions, Heat and cold Waves, Climatic Change: Global warming, Sea Level rise, Ozone Depletion

UNIT II

Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire. Oil fire, air pollution, water pollution, deforestation, Industrial wastewater pollution, road accidents, rail accidents, air accidents, sea accidents.

UNIT III

Disaster Management- Efforts to mitigate natural disasters at national and global levels. International Strategy for Disaster reduction. Concept of disaster management, national disaster management framework; financial arrangements; role of NGOs, Community-based organizations, and media. Central, State, District and local Administration; Armed forces in Disaster response; Disaster response: Police and other organizations.

Suggested Readings

- Gupta HK. 2003. *Disaster Management*. Indian National Science Academy. Orient Blackswan.
- Hodgkinson PE & Stewart M. 1991. *Coping with Catastrophe: A Handbook of Disaster Management*. Routledge.
- Sharma VK. 2001. *Disaster Management*. National Centre for Disaster Management, India.