

REVISED COURSES FOR ANIMAL GENETICS AND BREEDING

AG 611 ANIMAL CYTOGENETICS AND IMMUNOGENETICS	(2+1)
AG 612 POPULATIONS AND QUANTITATIVE GENETICS IN ANIMAL BREEDING	(3+1)
AG 613 SELECTION METHODS AND BREEDING SYSTEMS	(3+1)
AG 614** BIOMETRICAL TECHNIQUES IN ANIMAL BREEDING	(3+1)
AG 621 MOLECULAR GENETICS IN ANIMAL BREEDING	(2+1)
AG 622 CONSERVATION OF ANIMAL GENETIC RESOURCES	(2+0)
AG 623 LINEAR MODLES IN ANIMAL BREEDING	(2+1)
AG 624 CATTLE AND BUFFALO BREEDING	(2+1)
AG 625 SHEEP AND GOAT BREEDING	(2+0)
AG 619 MASTER'S SEMINAR	(1+0)
AG 629 MASTER'S SEMINAR	(1+0)
AG 699 MASTER'S RESEARCH	(20)
AG 711 RECENT ADVANCES IN ANIMAL GENETICS	(2+0)
AG 712 RECENT TRENDS IN ANIMAL BREEDING	(2+0)
AG 713 ADVANCES IN BIOMETRICAL GENETICS	(3+0)
AG 721 ADVANCES IN SELECTION METHODOLOGY	(3+0)
AG 722 ADVANCES IN MOLECULAR CYTOGENETICS	(2+0)
AG 723 UTILISATION OF NON-ADDITIVE GENETIC VARIANCE IN FARM ANIMALS	(3+0)
AG 719 DOCTORAL SEMINAR	(1+0)
AG 729 DOCTORAL SEMINAR	(1+0)
AG 799 DOCTORAL RESEARCH	(45)

SEMESTER-WISE DISTRIBUTION OF REVISED COURSES

M.Sc / M.V.Sc

Course No.	Nomenclature	Credits	Semester
AG 611	ANIMAL CYTOGENETICS AND IMMUNOGENETICS	2+1	I
AG 612	POPULATION AND QUANTITATIVE GENETICS IN ANIMAL BREEDING	3+1	I
AG 613	SELECTION METHODS AND BREEDING SYSTEMS	3+1	I
AG 614**	BIOMETRICAL TECHNIQUES IN ANIMAL BREEDING	3+1	I
AG 619	MASTER'S SEMINAR	1+0	I
AG 621	MOLECULAR GENETICS IN ANIMAL BREEDING	2+1	II
AG 622	CONSERVATION OF ANIMAL GENETIC RESOURCES	2+0	II
AG 623	LINEAR MODELS IN ANIMAL BREEDING	2+1	II
AG 624	CATTLE AND BUFFALO BREEDING	2+1	II
AG 625	SHEEP AND GOAT BREEDING	2+0	II
AG 629	MASTER'S SEMINAR	1+0	I
AG 699	MASTER'S RESEARCH	20	III-IV
Ph.D			
AG 711	RECENT ADVANCES IN ANIMAL GENETICS	2+0	I
AG 712	RECENT TRENDS IN ANIMAL BREEDING	2+0	I
AG 713	ADVANCES IN BIOMETRICAL GENETICS	3+0	I
AG 719	DOCTORAL SEMINAR	1+0	I
AG 721	ADVANCES IN SELECTION METHODOLOGY	3+0	II
AG 722	ADVANCES IN MOLECULAR CYTOGENETICS	2+0	II
AG 723	UTILISATION OF NON-ADDITIVE GENETIC VARIANCE IN FARM ANIMALS	3+0	II
AG 729	DOCTORAL SEMINAR	1+0	II
AG 799	DOCTORATE RESEARCH	45	

**** AG 614 (Biometrical techniques in animal breeding) presently offered as course No. AG 605 in II semester will be shifted to I semester from next academic session 2010-11**

AG 611 ANIMAL CYTOGENETICS AND IMMUNOGENETICS (2+1)

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:

In vitro preparation of somatic metaphase chromosomes; screening of chromosomal abnormalities; microphotography and karyotyping; banding procedures for comparing the chromosomal complement, FISH and PRINS. In vivo preparation of somatic metaphase chromosomes; screening of chromosomal abnormalities; microphotography and karyotyping; banding procedures for comparing the chromosomal complement.

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.

AG 612 POPULATION AND QUANTITATIVE GENETICS IN ANIMAL BREEDING (3+1)

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 coefficient. 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.

AG 613 SELECTION METHODS AND BREEDING SYSTEMS (3+1)

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 systems in animal

improvement. Selection for general and specific combining ability. Genetic polymorphysim 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. Compuatation of realized heritability and genetic correlation. Selection index: Computation, Accuracy and response in component traits. Estimation of hetrerosis. 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.

AG 614 BIOMETRICAL TECHNIQUES IN ANIMAL BREEDING (3+1)

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. Linear and non-linear regression. Methods of estimating regression parameters. Fitting the best regression equation. Regression on dummy variables. Fisher's discriminant function and its application, D^2 - Statistics in divergent analysis.

UNIT IV

Principle of least squares. Methods of analysis of unbalanced animal breeding data. Adjustment of data. Database management in animal breeding.

Practical:

Matrix applications, determinant and inverse of matrices. 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.

Suggested Readings:

Kaps M & Lamberson WR. 2004. *Biostatistics for Animal Science*. CABI.
Mather K & Jinks JL. 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.

AG 621 MOLECULAR GENETICS IN ANIMAL BREEDING (2+1)

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

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.

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.

AG 622 CONSERVATION OF ANIMAL GENETIC RESOURCES

(2+0)

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. 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

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*. 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.

AG 623 LINEAR MODELS IN ANIMAL BREEDING

(2+1)

Theory:

UNIT I

Introduction to linear models. Construction and assumptions of linear models. Fixed, random and mixed models.

UNIT II

Least squares procedure for fitting the linear models. One-way classification, one-way classification with a co-variable, two-way classification (with and without interaction).

UNIT III

Henderson's methods for estimation of variance components, Basic concepts of maximum likelihood method. BLUE and BLUP.

UNIT IV

Models of full rank and not of full rank. Generalized inverse of a matrix.

Practical:

Building of models for various types of data; fitting one-way model, one-way model with a co-variable and two-way models (with and without interaction). BLUE and BLUP estimates. Generalized inverse of a matrix.

Suggested readings:

Linear Models by S R Searle, John Wiley and Sons Inc., New York, USA.

Applications of Linear Models in Animal Breeding by C R Henderson, University of Guelph, Canada.

Least Squares Analysis of data with Unequal Subclass Number by W R Harvey, ARS, USDA, Maryland, USA.

AG 624 CATTLE AND BUFFALO BREEDING

(2+1)

Theory:

UNIT I

History of dairy cattle and buffalo breeding. Breeds of cattle and buffalo and their characterization. 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 model; and maternal grand sire model. Open nucleus breeding systems with MOET.

UNIT III

Methods of cross breeding. Breeding for 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 programmes. 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*. 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.

AG 625 SHEEP AND GOAT BREEDING

(2+0)

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.

AG 711 RECENT ADVANCES IN ANIMAL GENETICS (2+0)

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

AG 712 RECENT TRENDS IN ANIMAL BREEDING (2+0)

Theory:

UNIT I

Biometrical models and their analytical techniques for animal breeding data using computer application and use of programmes 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.

AG 713 ADVANCES IN BIOMETRICAL GENETICS**(3+0)****Theory:**

UNIT I

Analysis of longitudinal data, fixed and random regression models. Regression on dummy variable.

UNIT II

Classificatory problems; discriminant function, D^2 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).

Suggested Readings

Linear Models for the Prediction of Animal Breeding Values by R A Mrode (2nd Edition). CABI Publishing, Cambridge, USA.

Selected articles from journals.

AG 721 ADVANCES IN SELECTION METHODOLOGY**(3+0)****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.

Suggested Readings:

Selected articles from journals

AG 722 ADVANCES IN MOLECULAR CYTOGENETICS (2+0)

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.

**AG 723 UTILISATION OF NON-ADDITIVE GENETIC VARIANCE
IN FARM ANIMALS (3+0)**

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.

Suggested Readings:

Selected articles from journals.