## REVISED COURSES FOR ANIMAL GENETICS AND BREEDING

<table>
<thead>
<tr>
<th>Course Code</th>
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<th>Credits</th>
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<tbody>
<tr>
<td>AG 611</td>
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<td>(2+1)</td>
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<tr>
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### SEMESTER-WISE DISTRIBUTION OF REVISED COURSES

#### M.Sc / M.V.Sc

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** Ph.D **

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** 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.

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

Theory:

UNIT I
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:


Suggested Readings:


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

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:


Suggested Readings:


**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

UNIT IV

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:


**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:

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 (invivo 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.
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

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:

Suggested Readings:

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

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

UNIT III
Transgenetic animals their benefits in livestock production, somatic cell nuclear transfer, transgenetic 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 ad 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
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

UNIT III

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

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.